



Workshop Manual

Audi A6 2011 ➤

Audi A7 Sportback 2011 ➤

4-cylinder TDI engine (2.0 ltr. 4-valve common rail - generation II)

Engine ID	CGL C	CGL D	CMG B	CGL E					
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Edition 05.2019

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List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 21 - Turbocharging/supercharging
- 23 - Mixture preparation - injection
- 26 - Exhaust system
- 28 - Glow plug system

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



Contents

00 - Technical data	1
1 Identification	1
1.1 Engine number/engine data	1
2 Safety precautions	2
2.1 Safety precautions when working on the fuel system	2
2.2 Safety precautions when working on vehicles with start/stop system	2
2.3 Safety precautions when using testers and measuring instruments during a road test	3
2.4 Safety precautions when working on the subframe	3
2.5 Safety precautions when working on the cooling system	3
2.6 Safety precautions when working on the exhaust system	4
3 Repair instructions	5
3.1 Rules for cleanliness	5
3.2 General notes	5
3.3 General repair instructions	6
3.4 Nuts, bolts	7
3.5 Identification plates	7
3.6 Use of impact wrenches	7
3.7 Foreign particles in engine	8
3.8 Contact corrosion	8
3.9 Routing and attachment of pipes, hoses and wiring	8
3.10 Installing radiators and condensers	8
10 - Removing and installing engine	9
1 Removing and installing engine	9
1.1 Removing engine	9
1.2 Securing engine to engine and gearbox support	27
1.3 Installing engine	28
2 Assembly mountings	34
2.1 Exploded view - assembly mountings	34
2.2 Supporting engine in installation position	36
2.3 Removing and installing engine mountings	37
2.4 Removing and installing torque reaction support and cross member	38
2.5 Removing and installing gearbox mounting	39
3 Engine cover panel	41
3.1 Removing and installing engine cover panel	41
13 - Crankshaft group	42
1 Cylinder block (pulley end)	42
1.1 Exploded view - cylinder block (pulley end)	42
1.2 Exploded view - sealing flange (pulley end)	44
1.3 Removing and installing poly V-belt	45
1.4 Removing and installing tensioner for poly V-belt	47
1.5 Removing and installing vibration damper	47
1.6 Removing and installing bracket for ancillaries	48
1.7 Renewing crankshaft oil seal (pulley end)	49
1.8 Removing and installing sealing flange (pulley end)	51
2 Cylinder block (gearbox end)	55
2.1 Exploded view - cylinder block (gearbox end)	55
2.2 Removing and installing drive plate	56
2.3 Removing and installing sealing flange (gearbox end)	57
2.4 Renewing needle bearing in drive plate	65
3 Crankshaft	67



3.1	Exploded view - crankshaft	67
3.2	Crankshaft dimensions	68
3.3	Measuring axial clearance of crankshaft	68
3.4	Measuring radial clearance of crankshaft	68
3.5	Renewing spur gear	69
4	Pistons and conrods	73
4.1	Exploded view - pistons and conrods	73
4.2	Removing and installing pistons	75
4.3	Measuring piston projection at TDC	77
4.4	Checking pistons and cylinder bores	79
4.5	Checking radial clearance of conrod bearings	80
15 - Cylinder head, valve gear		81
1	Toothed belt drive	81
1.1	Exploded view - toothed belt	81
1.2	Removing and installing toothed belt	83
2	Cylinder head	93
2.1	Exploded view - cylinder head	93
2.2	Exploded view - cylinder head cover	95
2.3	Removing and installing cylinder head	98
2.4	Removing and installing cylinder head cover	107
2.5	Removing and installing seals for injectors	110
2.6	Checking compression	111
3	Valve gear	113
3.1	Exploded view - valve gear	113
3.2	Measuring axial clearance of camshaft	114
3.3	Measuring radial clearance of camshaft	115
3.4	Removing and installing camshaft oil seal	116
3.5	Removing and installing camshaft	118
3.6	Removing and installing valve stem oil seals	125
4	Inlet and exhaust valves	133
4.1	Machining valve seats	133
4.2	Checking valve guides	133
4.3	Checking valves	134
4.4	Valve dimensions	134
17 - Lubrication		135
1	Sump/oil pump	135
1.1	Exploded view - sump/oil pump	135
1.2	Engine oil	139
1.3	Removing and installing sump	139
1.4	Removing and installing oil pump	142
1.5	Removing and installing oil level and oil temperature sender G266	143
2	Engine oil cooler	144
2.1	Removing and installing engine oil cooler	144
3	Oil filter/oil pressure switches	145
3.1	Exploded view - oil filter	145
3.2	Removing and installing oil pressure switch F1	146
3.3	Removing and installing oil filter housing	146
3.4	Checking oil pressure	149
4	Balance shaft assembly	150
4.1	Removing and installing balance shaft assembly	150
19 - Cooling		157
1	Cooling system/coolant	157



1.1	Connection diagram - coolant hoses	157
1.2	Checking cooling system for leaks	160
1.3	Draining and filling cooling system	162
2	Coolant pump/thermostat assembly	169
2.1	Exploded view - coolant pump/thermostat	169
2.2	Exploded view - electric coolant pump	170
2.3	Removing and installing electric coolant pump	170
2.4	Removing and installing coolant pump	173
2.5	Checking thermostat	173
2.6	Removing and installing 4/2-way valve with thermostat	173
2.7	Removing and installing coolant temperature sender G62	176
2.8	Removing and installing radiator outlet coolant temperature sender G83	177
2.9	Removing and installing coolant valves	178
3	Coolant pipes	179
3.1	Exploded view - coolant pipes	179
3.2	Removing and installing coolant pipes	181
4	Radiator/radiator fan(s)	189
4.1	Exploded view - radiator/radiator fan(s)	189
4.2	Exploded view - radiator cowl and radiator fan	191
4.3	Removing and installing radiator	192
4.4	Removing and installing radiator cowl	195
4.5	Removing and installing radiator fan V7	199
21	Turbocharging/supercharging	202
1	Turbocharger	202
1.1	Exploded view - turbocharger	202
1.2	Removing and installing turbocharger	203
2	Charge air system	208
2.1	Exploded view - charge air system	208
2.2	Exploded view - hose connections for charge air system	209
2.3	Removing and installing charge air cooler	209
2.4	Removing and installing charge pressure sender G31	211
2.5	Checking charge air system for leaks	211
23	Mixture preparation - injection	214
1	Injection system	214
1.1	Overview - fuel system	214
1.2	Overview of fitting locations - injection system	216
1.3	Filling and bleeding fuel system	222
1.4	Checking fuel system for leaks	223
2	Vacuum system	224
2.1	Connection diagram - vacuum system	224
2.2	Checking vacuum system	224
3	Air cleaner	226
3.1	Exploded view - air cleaner housing	226
3.2	Removing and installing air cleaner housing	227
4	Intake manifold	229
4.1	Exploded view - intake manifold	229
4.2	Removing and installing intake manifold	230
4.3	Removing and installing throttle valve module J338	233
4.4	Cleaning throttle valve module J338	233
5	Injectors/high-pressure reservoir (rail)	236
5.1	Exploded view - injectors	236
5.2	Performing adaption of correction values for injectors	239



5.3	Checking injectors	239
5.4	Checking return flow rate of injectors with engine running	240
5.5	Checking return flow rate of injectors at starter cranking speed	243
5.6	Checking for injectors sticking open	244
5.7	Removing and installing injectors	246
5.8	Removing and installing high-pressure pipes	250
5.9	Removing and installing high-pressure reservoir (rail)	251
6	Senders and sensors	255
6.1	Removing and installing fuel pressure regulating valve N276	255
6.2	Checking fuel pressure regulating valve N276	257
6.3	Removing and installing fuel pressure sender G247	258
6.4	Removing and installing air mass meter G70	261
7	High-pressure pump	262
7.1	Exploded view - high-pressure pump	262
7.2	Removing and installing high-pressure pump	263
8	Lambda probe	266
8.1	Exploded view - Lambda probe	266
8.2	Removing and installing Lambda probe	266
9	Engine control unit	268
9.1	Wiring and component check	268
9.2	Removing and installing engine/motor control unit J623	269
26	- Exhaust system	273
1	Exhaust pipes/silencers	273
1.1	Exploded view - silencers	273
1.2	Removing and installing front exhaust pipe	275
1.3	Separating exhaust pipes/silencers	276
1.4	Renewing tailpipes	278
1.5	Stress-free alignment of exhaust system	279
1.6	Checking exhaust system for leaks	280
2	Emission control system	281
2.1	Removing and installing particulate filter	281
2.2	Removing and installing pressure differential sender G505	282
3	Exhaust gas temperature control	284
3.1	Exploded view - exhaust gas temperature control	284
3.2	Removing and installing exhaust gas temperature sender	285
4	Exhaust gas recirculation	290
4.1	Exploded view - exhaust gas recirculation system	290
4.2	Removing and installing exhaust gas recirculation cooler	291
4.3	Checking exhaust gas recirculation cooler change-over	293
4.4	Cleaning exhaust gas recirculation system	294
5	Exhaust manifold	302
5.1	Exploded view - exhaust manifold	302
5.2	Removing and installing exhaust manifold	303
28	- Glow plug system	305
1	Glow plug system	305
1.1	Exploded view - glow plug system	305
1.2	Removing and installing glow plug	305
1.3	Removing and installing Hall sender G40	307
1.4	Removing and installing engine speed sender G28	308



00 – Technical data

1 Identification

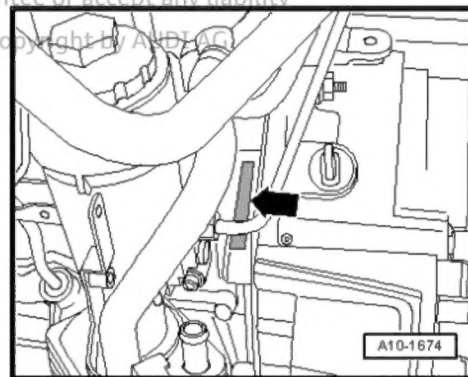
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⇒ ["1.1 Engine number/engine data", page 1](#)

1.1 Engine number/engine data

Engine number

- ◆ The engine number ("engine code" and "serial number") -arrow- can be found on the left side (seen in the direction of travel) at the joint between engine and gearbox.
- ◆ There is also a sticker with "engine code" and "serial number" attached to the toothed belt cover.
- ◆ Engine codes starting with the letter "C" have four letters (previously three letters).
- ◆ The first 3 characters of the engine code stand for the engine capacity and the mechanical construction and design. They are stamped onto the cylinder block together with the serial number.
- ◆ The 4th character indicates the power output and torque of the engine and is determined by the engine control unit.



Note

- ◆ *The four-letter engine code is found on the type plate (certain countries only), vehicle data sticker and engine control unit.*
- ◆ *Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 411 .*

For engine data refer to ⇒ Technical data for diesel engines; Rep. gr. 00 ; Overview of engines .



2 Safety precautions

⇒ ["2.1 Safety precautions when working on the fuel system", page 2](#)

⇒ ["2.2 Safety precautions when working on vehicles with start/stop system", page 2](#)

⇒ ["2.3 Safety precautions when using testers and measuring instruments during a road test", page 3](#)

⇒ ["2.4 Safety precautions when working on the subframe", page 3](#)

⇒ ["2.5 Safety precautions when working on the cooling system", page 3](#)

⇒ ["2.6 Safety precautions when working on the exhaust system", page 4](#)

2.1 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

Risk of injury - fuel system operates under high pressure

The fuel system is pressurised. There is a risk of injury as fuel may spray out.

Before opening the fuel system:

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap a clean cloth around connection and open connection carefully).

Risk of fire due to escaping fuel

If the battery is connected, the door contact switch activates the fuel pump when the driver's door is opened. Escaping fuel may ignite, causing a fire.

- Before opening the fuel system, disconnect power supply to fuel pump.

2.2 Safety precautions when working on vehicles with start/stop system

Please note the following when working on vehicles with start/stop system:

Risk of injury - engine may start unexpectedly

The engine can start unexpectedly if the vehicle's start/stop system is activated. A message in the instrument cluster indicates whether the start/stop system is activated.

- To deactivate the start/stop system, switch off the ignition.



2.3 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:

Risk of injury if test equipment is not secured

If an accident occurs and the front passenger's airbag is triggered, test equipment which is not secured adequately may be catapulted through the vehicle with potentially serious consequences.

- Secure test equipment on the rear seat with a strap.

Or: with respect to the correctness of information in this document. Copyright by AUDI AG.

- Have a second mechanic operate test equipment on the rear seat.

2.4 Safety precautions when working on the subframe

Please note the following warnings when working on the subframe:



Caution

Risk of damage to running gear components.

- ◆ *The vehicle must NOT be lowered onto its wheels if the engine/gearbox mountings, steering rack or subframe cross brace are not properly installed.*
- ◆ *The vehicle must NOT be supported by applying a trolley jack or similar to the subframe or subframe cross brace.*

2.5 Safety precautions when working on the cooling system

When working on the cooling system note the following:

Risk of scalding as hot coolant can escape

The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

- Put on protective gloves.
- Put on safety goggles.
- Cover filler cap on expansion tank with a cloth and open carefully to release pressure.



Caution

Overheating can occur if the filler cap is not fitted properly.

- ◆ *Close filler cap on coolant expansion tank (make sure it engages).*

2.6 Safety precautions when working on the exhaust system

Risk of injury when disconnecting the exhaust system

There is a risk of eye irritation caused by soot particles in the air.

- Put on safety goggles.

Danger from toxic exhaust gases

The auxiliary/supplementary heater produces toxic exhaust gases during operation. There is a risk of poisoning and of damage to the respiratory tract.

- In enclosed spaces, only switch on the auxiliary/supplementary heater if there is an exhaust extraction system.
- In enclosed spaces without an exhaust extraction system, switch off the auxiliary/supplementary heater.



Risk of damage to flexible joint

The flexible joint can be damaged or develop leaks if it is handled incorrectly.

- Do not bend flexible joint more than 10°.
- Install flexible joint so that it is not under tension.



3 Repair instructions

⇒ ["3.1 Rules for cleanliness", page 5](#)

⇒ ["3.2 General notes", page 5](#)

⇒ ["3.3 General repair instructions", page 6](#)

⇒ ["3.4 Nuts, bolts", page 7](#)

⇒ ["3.5 Identification plates", page 7](#)

⇒ ["3.6 Use of impact wrenches", page 7](#)

⇒ ["3.7 Foreign particles in engine", page 8](#)

⇒ ["3.8 Contact corrosion", page 8](#)

⇒ ["3.9 Routing and attachment of pipes, hoses and wiring", page 8](#)

⇒ ["3.10 Installing radiators and condensers", page 8](#)

3.1 Rules for cleanliness

Even small quantities of dirt can lead to defects. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- ◆ Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- ◆ Seal off open pipes and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- ◆ After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in the proper packaging (e.g. in tool boxes etc.).
- ◆ Do not work with compressed air when the system is open. If possible, do not move vehicle.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.
- ◆ Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

3.2 General notes

Fuel supply/injection

- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probe.



- ◆ The vehicles are fitted with a crash fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump.
- ◆ At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system ⇒ [page 2](#) .

3.3 General repair instructions



Caution

The high-pressure pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be filled and bled before the engine is started for the first time*
⇒ ["1.3 Filling and bleeding fuel system", page 222](#) .
- ◆ Clean tools and workbench etc. before working on the injection system.
- ◆ Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- ◆ If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- ◆ Take care not to damage the injectors when removing the old copper seals.
- ◆ Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- ◆ Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- ◆ Never attempt to bend high-pressure fuel lines to shape.
- ◆ When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- ◆ Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- ◆ Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- ◆ When the engine is running, do not perform any repairs to the common rail system.
- ◆ Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- ◆ All cable ties which are released or cut open when removing must be refitted in the same position when installing.



- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.

3.4 permitted Nuts, bolts

- ◆ Loosen bolts in reverse sequence to specified tightening sequence.
- ◆ Bolts and nuts used to secure covers and housings must be tightened in steps according to the specified tightening sequence and method.
- ◆ Bolts and nuts which secure covers and housings should be loosened and tightened in diagonal sequence and in stages if no tightening sequence is specified.
- ◆ Always renew self-locking bolts and nuts.
- ◆ Unless otherwise specified, use a wire brush to clean the threads of bolts which are secured with locking fluid. Then install bolts with locking fluid; for locking fluid refer to ⇒ Electronic parts catalogue .
- ◆ Threaded holes which take self-locking bolts or bolts coated with locking fluid must be cleaned using a thread tap or similar. Otherwise there is a danger of the bolts shearing off the next time they are removed.
- ◆ The tightening torques stated apply to non-oiled nuts and bolts.

3.5 Identification plates

When renewing vehicle components, the identification plates on the old parts that have a replacement part number (see ⇒ Electronic parts catalogue) must be attached to the new parts due to approval regulations.

3.6 Use of impact wrenches

In general, it is permitted to use an impact wrench to unscrew bolts and nuts. An exception to this is when work is performed inside an open high-voltage battery. For this work, it is not permitted to use an impact wrench.

An impact wrench may be used to screw in bolts and nuts when performing repair work if the following requirements are observed. In general, electric and compressed-air impact wrenches should be used.

Requirements:

- Only screw in bolts with locking fluid or self-locking nuts at low speed.
- Use a suitable impact wrench with variable speed and adjustable torque range.
- Use suitable bits when working in the vicinity of sensitive surfaces, e.g. plastic-coated bits for aluminium rims.
- When working in the vicinity of natural gas systems, observe the information in the Workshop Manual "Natural gas engines - General information".

Use:

- Fit bolts/nuts by hand.



- Only use an impact wrench to screw in bolts/nuts until the head of the bolt/nut makes contact and then continue tightening with a torque wrench.
- Clean threaded pins before unscrewing the bolt/nut.

3.7 Foreign particles in engine

- ◆ When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.



Note

If the turbocharger has suffered mechanical damage

⇒ [page 203](#)

3.8 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are fitted.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Please note:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend using Audi Genuine Accessories.
- ◆ Damage caused by contact corrosion is not covered by warranty.

3.9 Routing and attachment of pipes, hoses and wiring

- ◆ Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- ◆ To avoid damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (limited space in engine compartment).

3.10 Installing radiators and condensers

Even when the radiator, condenser and charge air cooler are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator, charge air cooler or condenser.



10 – Removing and installing engine

1 Removing and installing engine

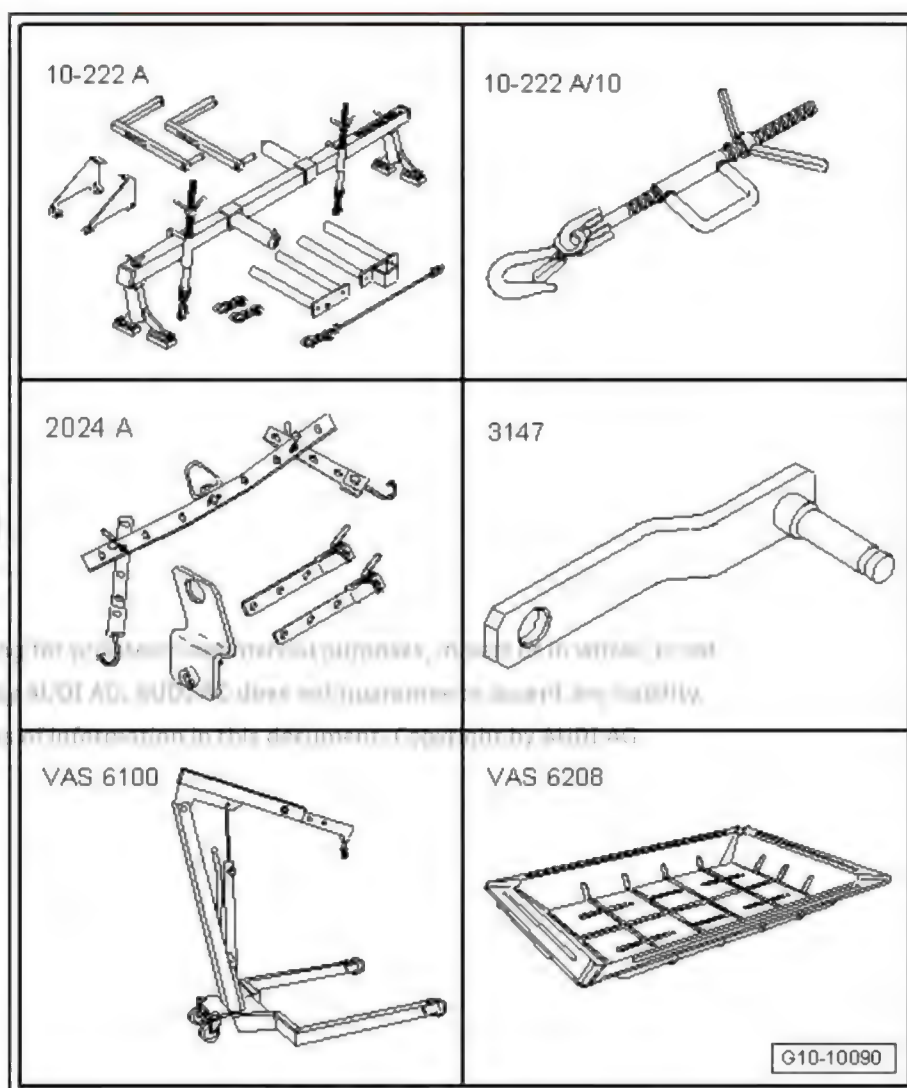
⇒ ["1.1 Removing engine", page 9](#)

⇒ ["1.2 Securing engine to engine and gearbox support", page 27](#)

⇒ ["1.3 Installing engine", page 28](#)

1.1 Removing engine

Special tools and workshop equipment required



- ◆ Support bracket - 10 - 222 A-
- ◆ Hook - 10 - 222 A /10-
- ◆ Lifting tackle - 2024 A-
- ◆ Workshop hoist - VAS 6100-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Gearbox support - 3147-



◆ Hooks - 10 - 222 A /2-



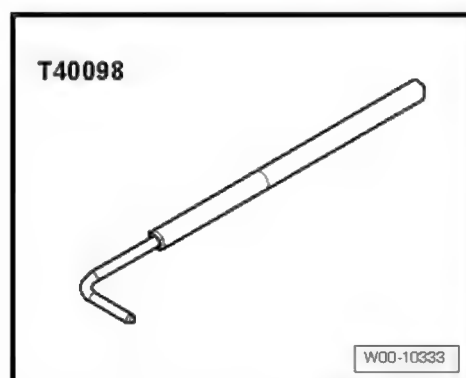
◆ Removal lever - 80 - 200-



◆ Hose clip pliers - VAS 6362-



◆ Locking tool - T40098-





Procedure



Note

- ◆ The engine is removed upwards without gearbox.
- ◆ Fit cable ties in the original positions when installing.



Caution

When disconnecting the battery there is a risk of irreparable damage to electronic components.

- ◆ Observe notes on procedure for disconnecting the battery.

- Disconnect earth wire from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Remove engine cover panel -arrows-.

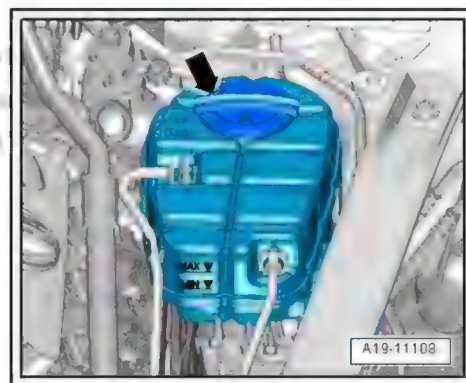
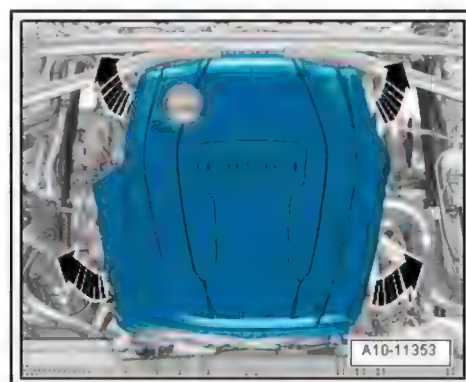


WARNING

Risk of scalding due to hot steam and hot coolant.

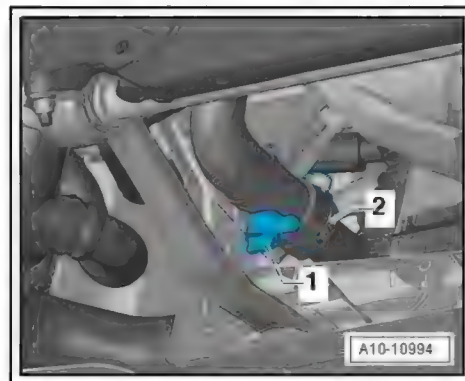
- ◆ The cooling system is under pressure when the power unit is hot.
- ◆ To allow pressure to dissipate, cover filler cap on coolant expansion tank with cloth and open carefully.

- Open filler cap -arrow- on coolant expansion tank.
- Remove front wheels ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres .
- Remove wheel spoilers (front) on both sides ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Remove drive shaft cover on both sides ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Remove noise insulation panels ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



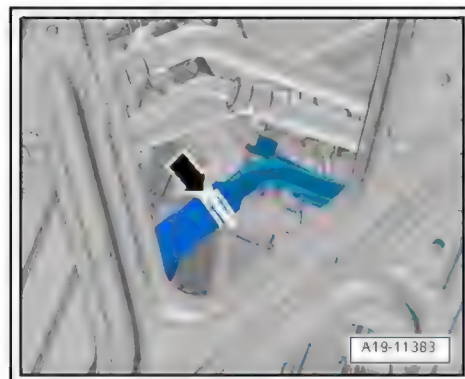


- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Open drain screw -1- at connection and drain off coolant; then detach connection -2- from radiator (lift retaining clip).
- Move coolant hose clear at longitudinal member.



Vehicles with multitronic gearbox:

- Release hose clip -arrow-, disconnect coolant hose and drain off coolant.

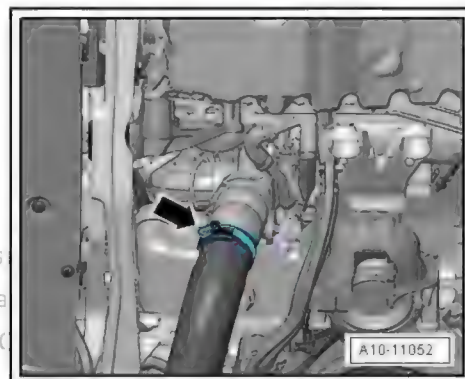


All vehicles (continued):

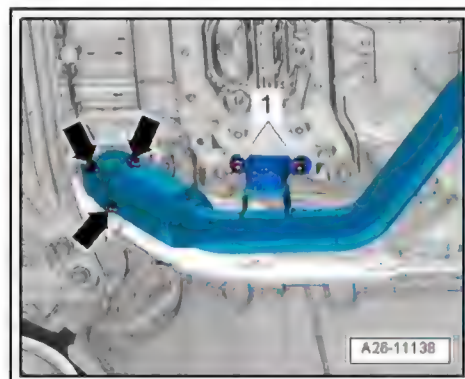
- Release hose clip -arrow-, disconnect air hose and press to one side.



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- Remove nuts -arrows- and bolts -1- for front exhaust pipe.





Caution

Risk of damage to flexible joints in front exhaust pipe

- ◆ *Do not bend flexible joints in front exhaust pipe more than 10°.*

- Loosen bolts -arrows-, push back clamp and detach front exhaust pipe.

- Remove bolt -2- on mounting for particulate filter.



Note

Disregard -item 1-

- Remove bolts -1- and detach torque reaction support.
- Remove bolts -2- on both sides and detach cross member -3-.

Vehicles with multitronic gearbox:

- Remove subframe cross brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe cross brace .



Caution

Risk of damage to running gear components.

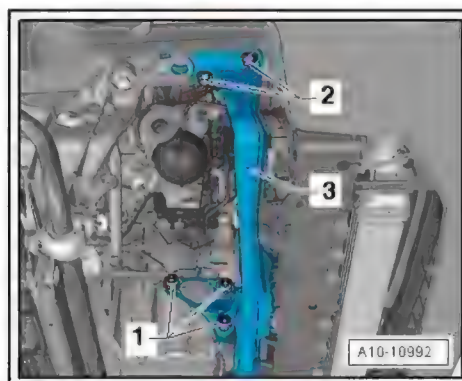
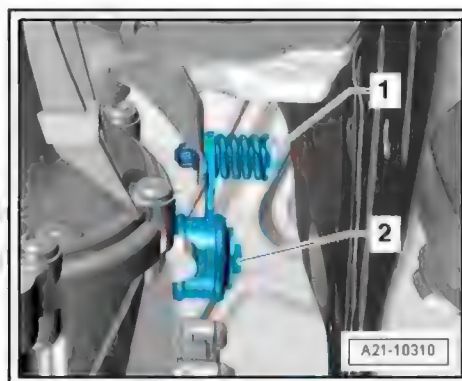
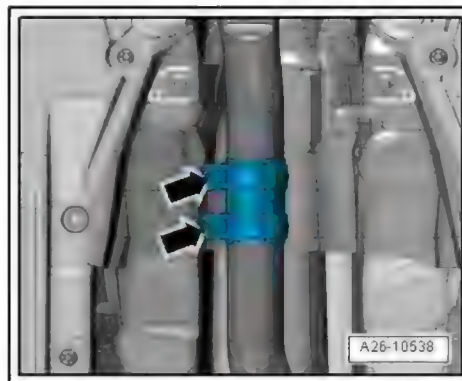
- ◆ *The vehicle must NOT be lowered onto all four wheels if the engine/gearbox mountings, steering rack or subframe cross brace are not properly installed.*

- Unplug electrical connector -3- and move clear.
- Release hose clip -2- and detach coolant hose.



Note

-Item 1- and -arrows- can be disregarded.

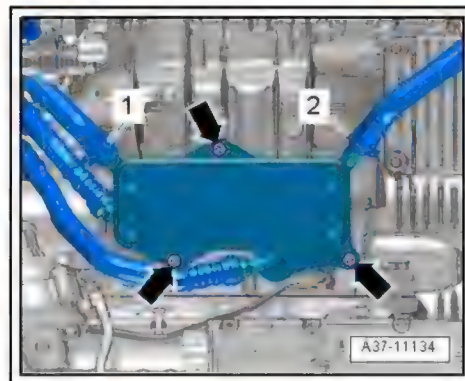




Note

Place a cloth underneath the ATF cooler to catch escaping coolant.

- Release hose clip -1- and detach coolant hose.
- Remove bolts -arrows-, detach ATF cooler and push to one side.



Note

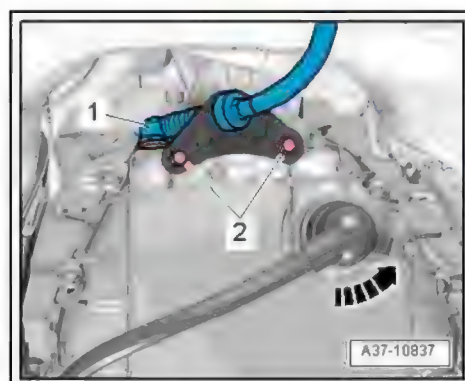
Disregard -item 2-.



Caution

Risk of irreparable damage to gearbox control unit (mechanic unit) because of static discharge.

- ◆ Before unplugging or plugging in electrical connector, mechanic must discharge static electricity. To do so, touch vehicle earth, heater radiator, or lifting platform, with your hand.
- ◆ Do NOT touch connector contacts in gearbox connector with your hands.



- Turn retainer catch anti-clockwise -arrow-, then unplug electrical connector at gearbox and move wiring clear.

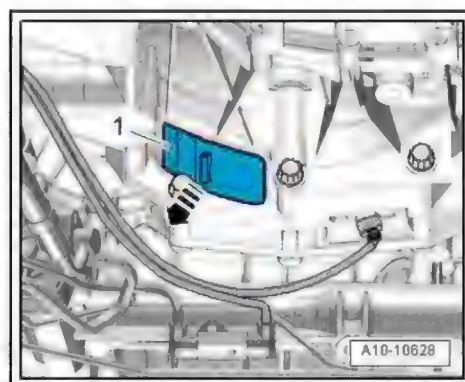


Note

Disregard items -1 and 2-.

All vehicles (continued):

- Detach bottom cover -1- from gearbox -arrow-.

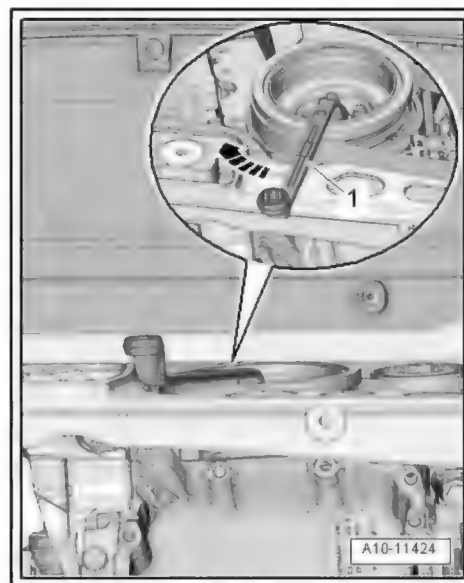


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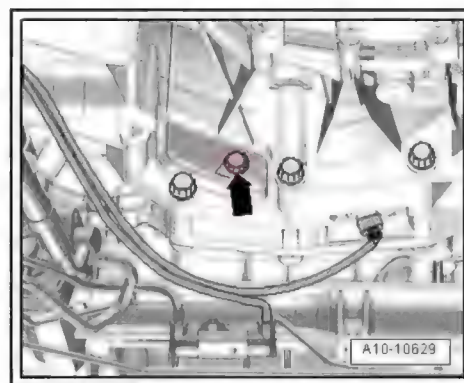
- Detach cap from vibration damper.
- Counterhold crankshaft on central bolt for vibration damper using angled ring spanner -1- when loosening bolts for drive plate.



When performing the next step, turn the crankshaft only in the normal direction of rotation -arrow-.



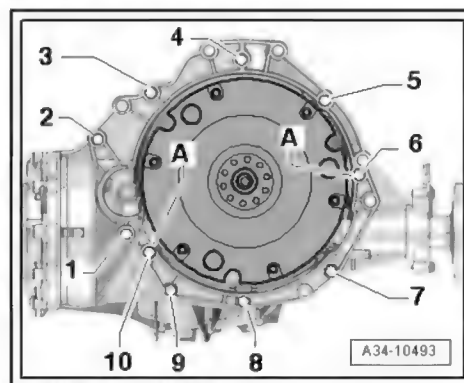
- Remove 3 bolts -arrow- for drive plate, turning crankshaft 120° in normal direction of rotation each time.



- Remove bolts -1, 7, 8, 9, 10- securing engine to gearbox.



Disregard -item A-.



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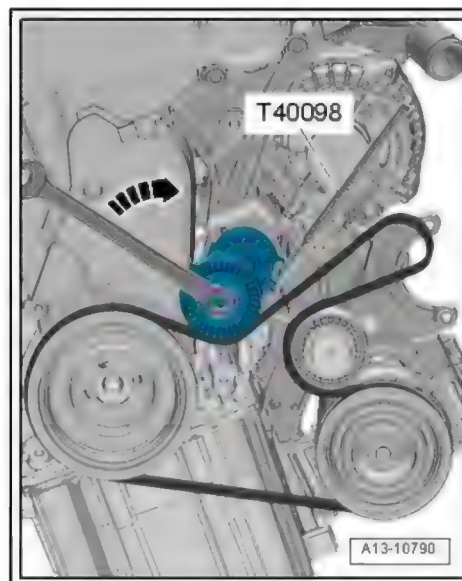


Caution

Running a used poly V-belt in the opposite direction could cause irreparable damage.

- ◆ *Before removing the poly V-belt, mark the direction of rotation with chalk or a felt-tip pen for re-installation.*

- Swivel tensioner in clockwise direction -arrow-, detach poly V-belt from pulley for air conditioner compressor and lock tensioner using locking tool - T40098- .
- Take off poly V-belt.



- Unplug electrical connector -1- and move wiring clear.

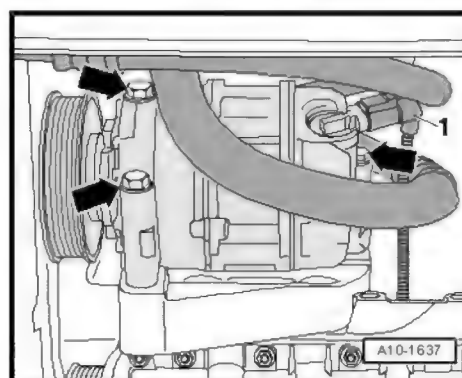


WARNING

Risk of injury caused by refrigerant.

- ◆ *The air conditioner refrigerant circuit must not be opened.*

- Remove bolts -arrows- for air conditioner compressor.

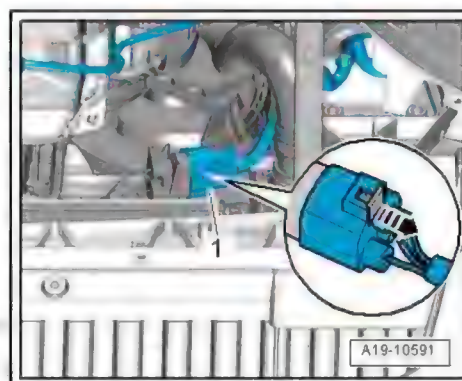


Caution

Risk of damage to refrigerant lines and hoses.

- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*

- Tie up air conditioner compressor together with lines to one side (lines remain connected).
- Take electrical connector -1- for radiator fan out of bracket and unplug connector (push retainer to the rear -arrow- and press down release catch).
- Move clear electrical wiring harness going to radiator fan control unit.

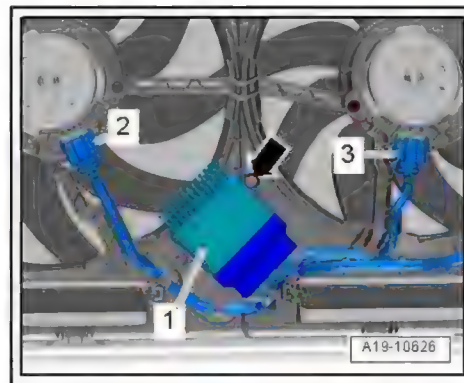


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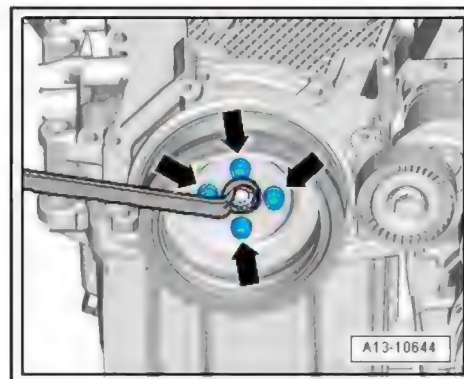
- Remove bolt -arrow-, release fastener and move radiator fan control unit - J293- -item 1- clear to one side.



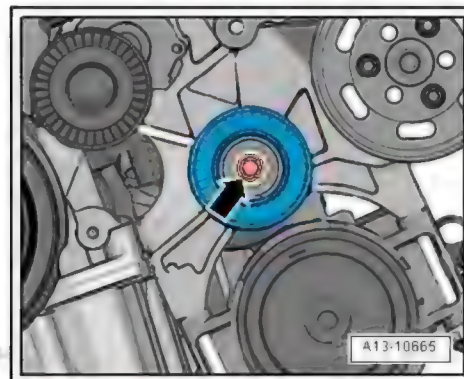
Disregard items -2 and 3-.



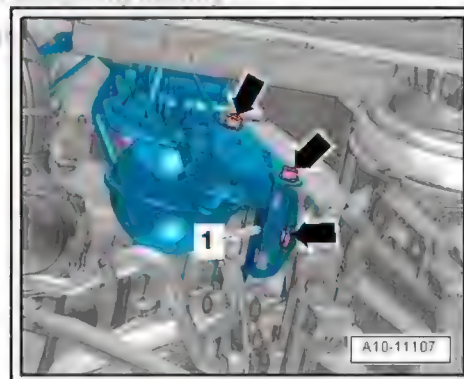
- Remove bolts -arrows- (counterhold at central bolt).
- Remove vibration damper.



- Pull off cover cap for idler roller.
- Remove bolt -arrow- and detach idler roller.



- Remove bolts -arrows- and move bracket -1- to the rear.
- Remove lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .





- Remove bolts -arrows- and detach air duct -1-.



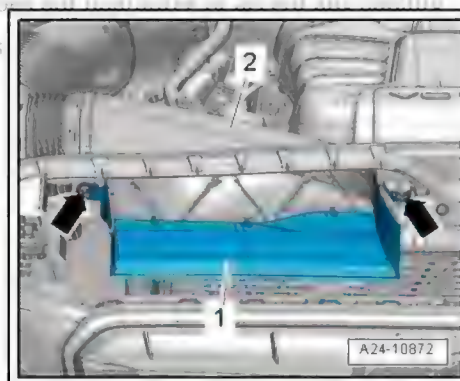
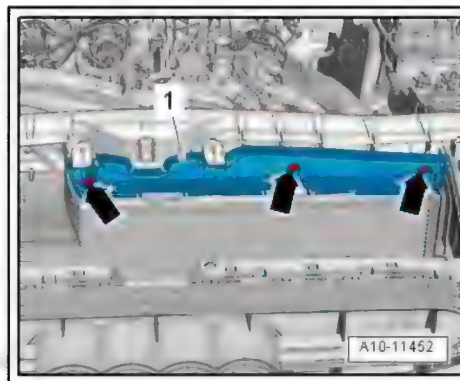
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- Remove bolts -arrows- and detach air duct -2-.

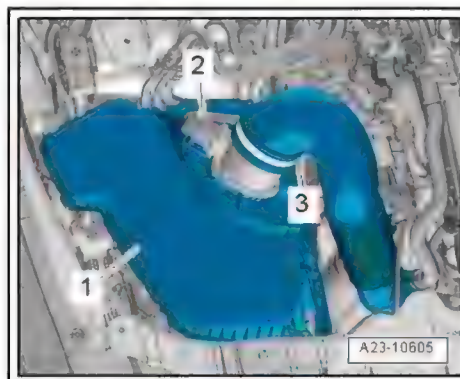


Note

Disregard -item 1-.



- Unplug electrical connector -2-.
- Release hose clip -3- and detach air hose from air mass meter - G70- .
- Detach air cleaner housing -1-.

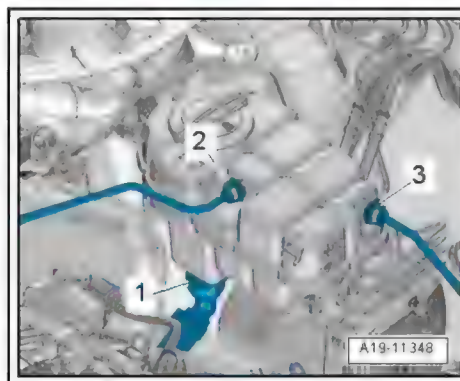


- Lift retaining clips -1- and -2- and disconnect coolant hoses.



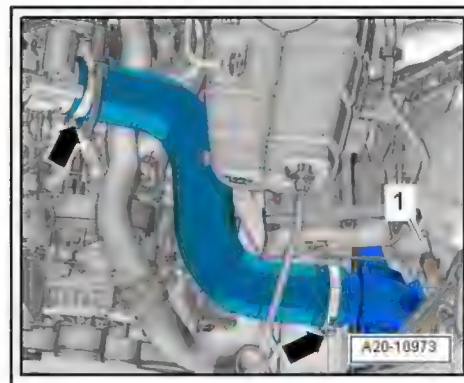
Note

Disregard -item 3-.

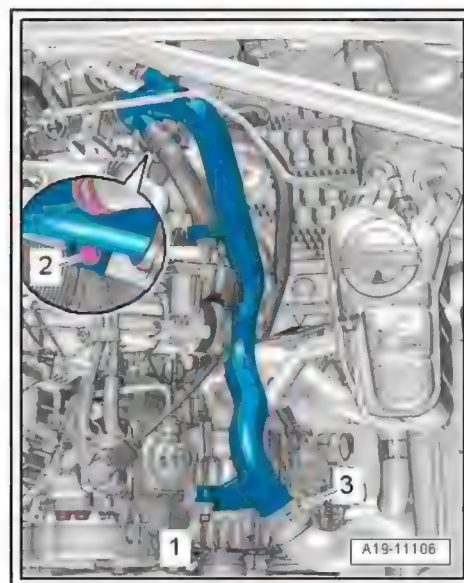




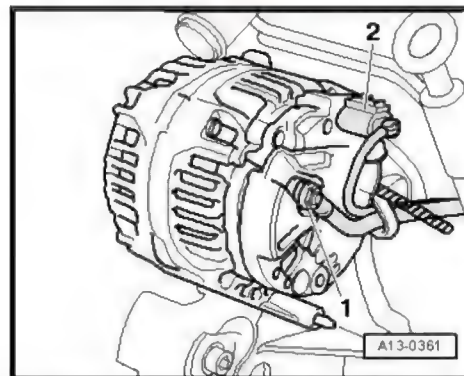
- Release hose clips -arrows- and remove air hose.
- Unplug electrical connector for charge pressure sender - G31- / intake air temperature sender - G42- -item 1- and move wiring clear.



- Remove bolts -1, 2-.
- Release hose clip -3- and detach coolant hose.



- Unscrew terminal 30/B+ -item 1-.
- Unplug electrical connector -2-.

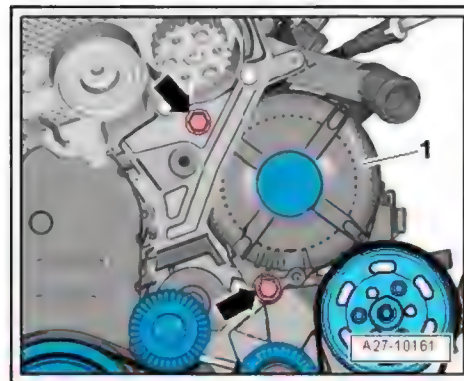


- Remove bolts -arrows-.
- Move coolant pipe (top left) to side and detach alternator -1-.



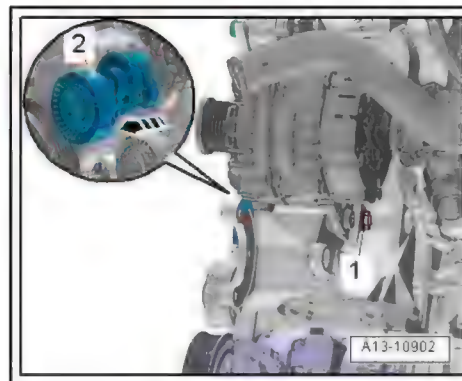
Note

- ◆ If alternator sticks in its bracket, screw bolts back in again down to the last 2 turns.
- ◆ Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.

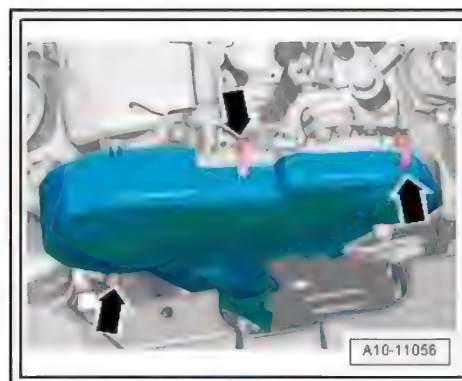




- Remove bolt -1- and take off poly V-belt tensioner -2- -arrow-.



- Release retaining clips -arrows- and detach toothed belt cover (top).

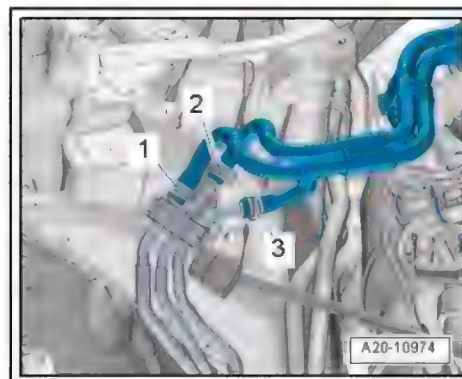


Caution

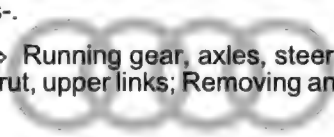
Protect fuel system against contamination.

- ◆ *Rules for cleanliness when working on the injection system ⇒ [page 5](#).*

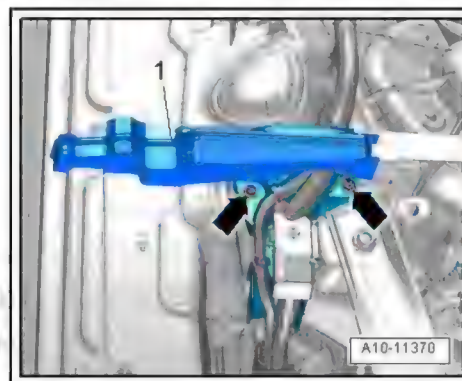
- Disconnect fuel supply hose -3- and fuel return hoses -1, 2-.



- Press foam wedge -1- to one side.
- Remove bolts -arrows-.
- Remove body brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Suspension strut, upper links; Removing and installing body brace .



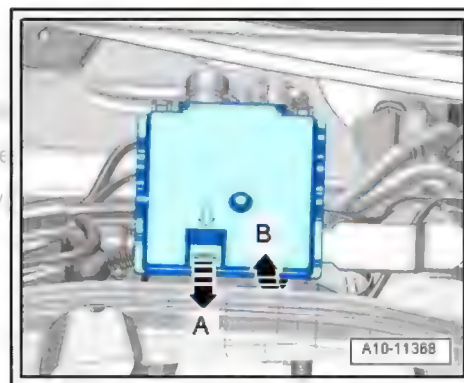
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- Release catch -arrow A- and open cover -arrow B-.

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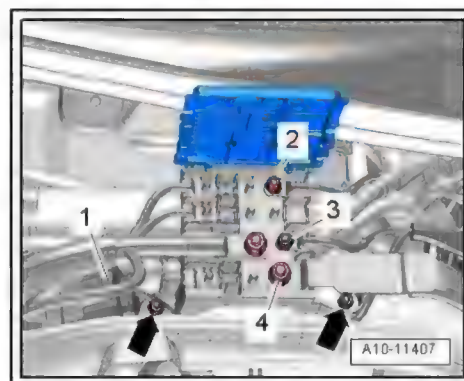


- Remove nuts -2 and 4- and move electrical wiring clear.
- Detach electrical connector -1- from bracket and unplug.
- Remove nuts -arrows- and detach terminal 30 wiring junction - TV2- from plenum chamber partition panel.

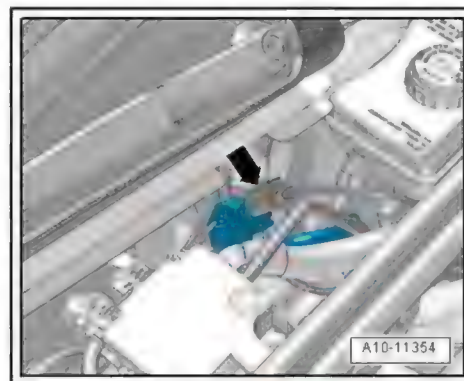


Note

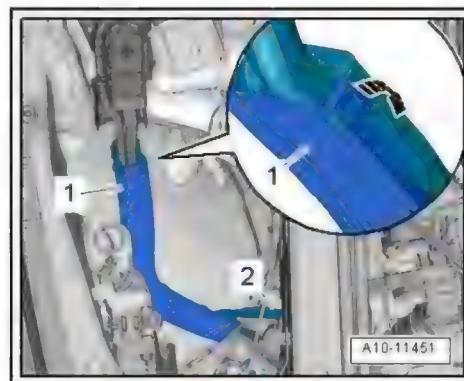
Disregard -item 3-.



- If fitted, unplug electrical connector at brake servo pressure sensor - G294- -arrow-.

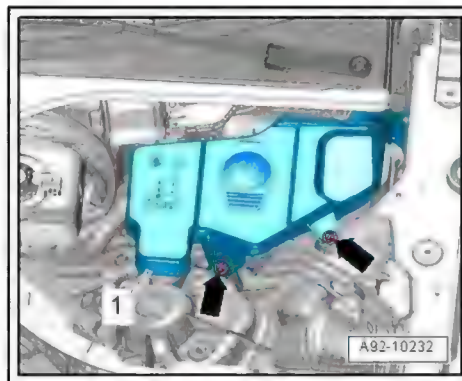


- Unscrew nut -2- on longitudinal member (right-side) and move earth cables clear.
- Release catch -arrow- to open wiring duct -1- and move electrical wiring harness clear.

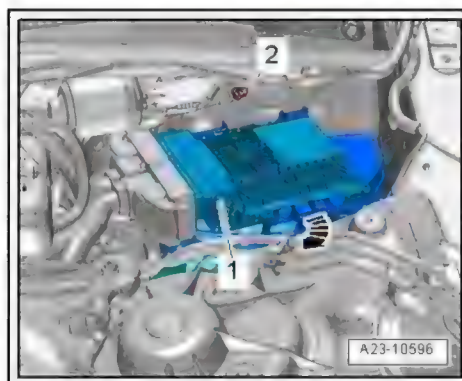




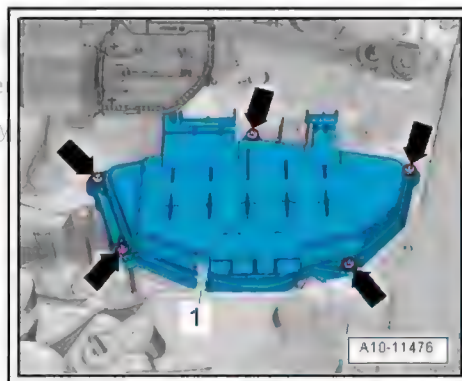
- Unscrew bolts -arrows- and pull filler neck -1- out of washer fluid reservoir and through opening in body to right side.



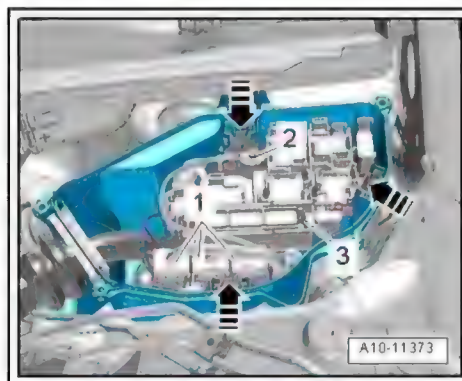
- Remove cap nut -2- and move earth wiring clear.
- Release fastener -arrow-, detach engine control unit - J623- item 1- from bracket and swivel it to one side.



- Remove bolts -arrows- and detach cover -1- for electronics box in plenum chamber.
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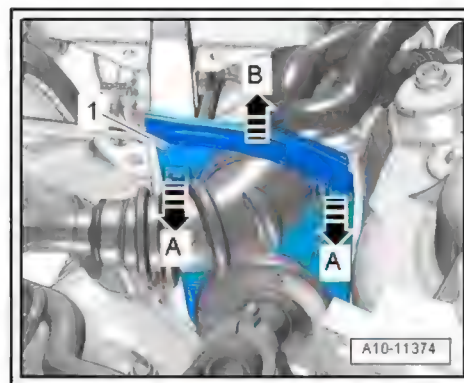


- Unplug electrical connectors -1- and unscrew nut -2- for electrical wiring.
- Release catches -arrows- and detach relay carrier with fuse holder -3-.
- Disengage engine wiring harness at electronics box in plenum chamber and move clear.





- Release catches -arrows A- and lift off wiring protector -1- -arrow B-.
- Place wiring harness on engine and secure engine/motor control unit - J623- to prevent it from dropping.

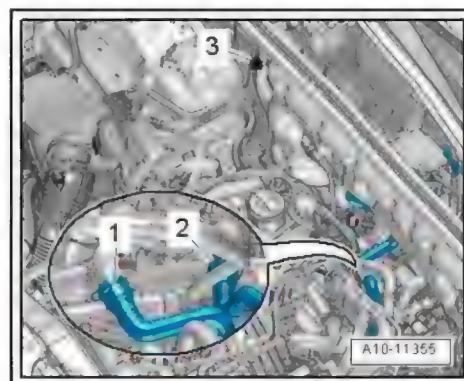


- Lift retaining clips -1 and 2-, disconnect coolant hoses and guide coolant hose through plenum chamber partition panel.



Note

Disregard -item 3-.



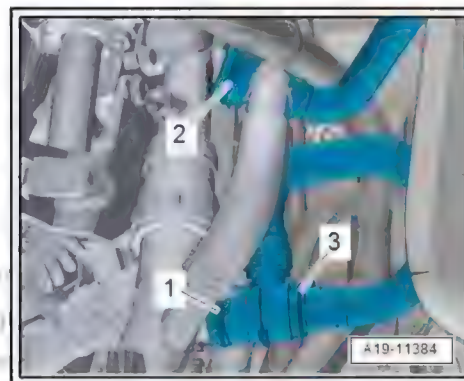
Vehicles with multitronic gearbox:

- Lift retaining clips -1, 2 and 3-, disconnect coolant hoses and guide relevant coolant hoses through plenum chamber partition panel.

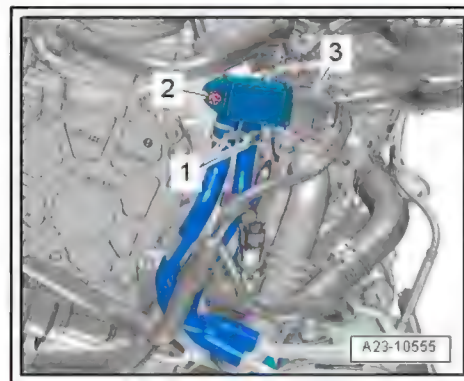
All vehicles (continued):

- Remove plenum chamber partition panel ➔ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel

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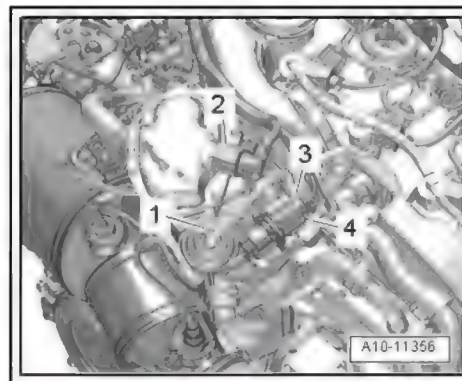


- Unplug electrical connector -3- for pressure differential sender - G505- .
- Remove bolt -2- and move hoses -1- clear at bracket.
- Move pressure differential sender - G505- to rear.
- Remove Lambda probe - G39- ➔ [page 266](#) .

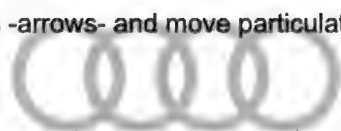




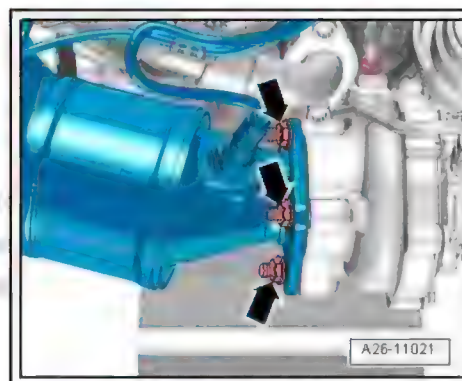
- Unplug electrical connectors -4- for exhaust gas temperature sender 3 - G495- and move electrical wiring clear.



- Remove nuts -arrows- and move particulate filter to rear.



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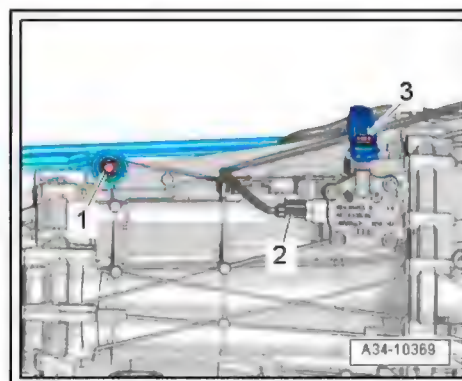
Vehicles with manual gearbox:

- Unplug electrical connector -2- at reversing light switch - F4- and move electrical wire clear.



Note

Disregard items -1 and 3-.

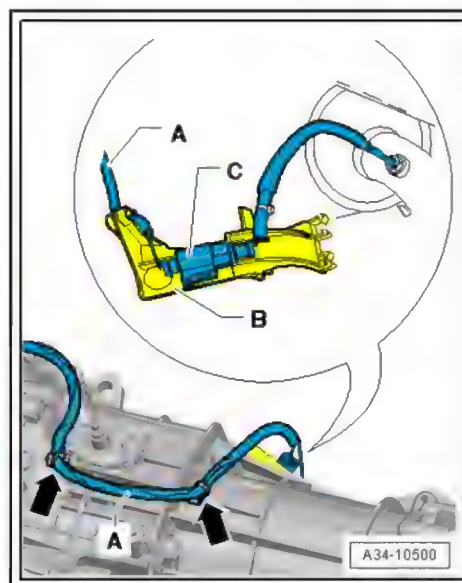


- Unclip electrical connector -C- from bracket -B- and unplug.



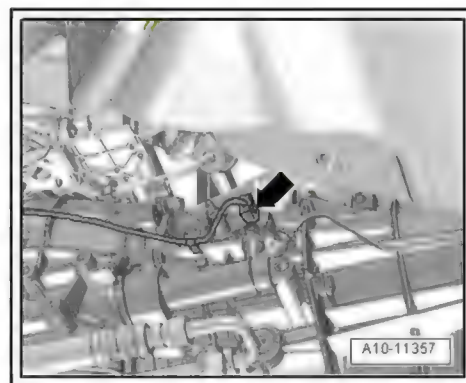
Note

Disregard -item A- and -arrows-.





- Unplug electrical connector -arrow- for gearbox neutral position sender - G701- and move electrical wire clear.

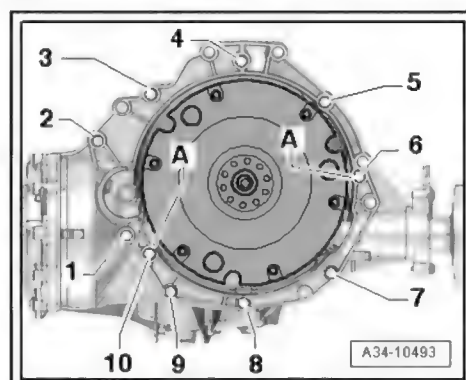


- Remove bolts -2 ... 6- securing gearbox to engine.
- Separate starter from gearbox and leave in position.



Note

Disregard -item A-.

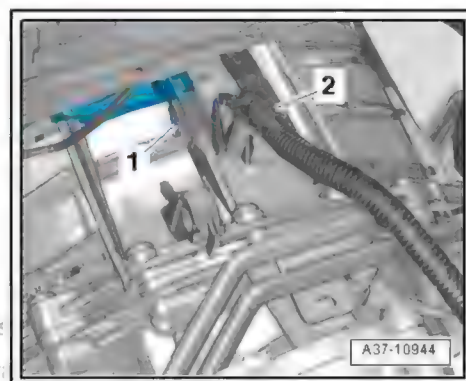


Vehicles with multitronic gearbox:

- Detach electrical connector -1- from bracket and move electrical wiring harness -2- clear using removal lever - 80 - 200- .



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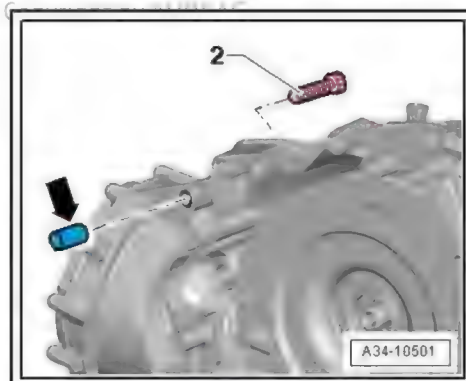


All vehicles (continued):



Note

Bolt -2- secures the starter to the gearbox and is provided with an additional spacer sleeve -arrow-.



- Set up support bracket - 10 - 222 A- on suspension turrets (left and right) as illustrated.
- Attach gearbox support - 3147- to gearbox and to hook - 10 - 222 A /2- using hook - 10 - 222 A /10- .



Note

For illustration purposes, the installation position is shown with the engine removed.

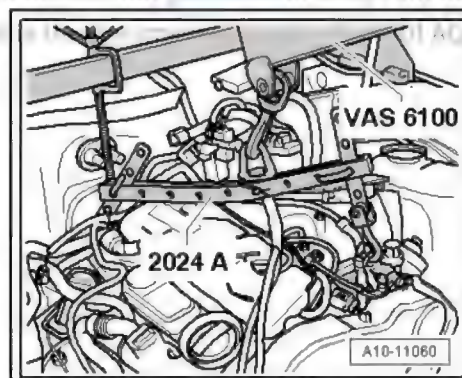
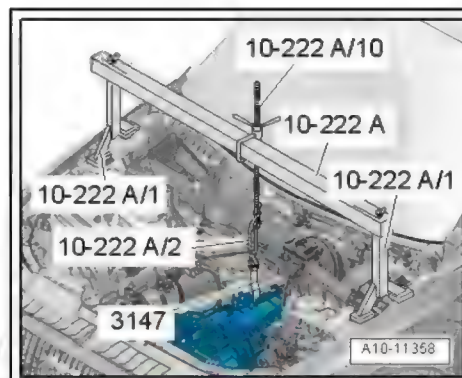
- Take up weight of gearbox with spindle of support bracket.
- Remove lifting eye of lifting tackle - 2024 A- (pull out split pin and press out pin).
- Reinsert lifting eye in 4th hole from front on lifting tackle.
- Secure pin with split pin again.
- Attach lifting tackle - 2024 A- to engine and workshop hoist - VAS 6100- as shown in illustration.



WARNING

Accident risk from loose components of lifting tackle.

- ♦ *The support hooks and retaining pins on the lifting tackle must be secured with locking pins.*



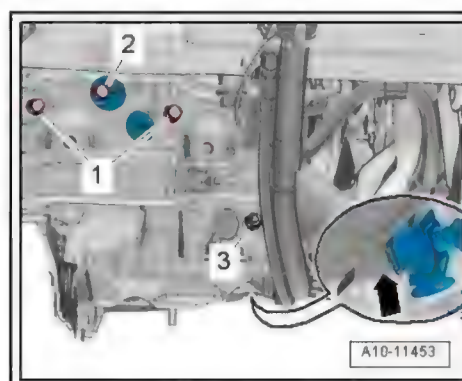
- Remove bolts -2- for engine mounting on both sides.
- Remove nut -3- and move bracket with electrical wiring clear.
- If fitted, remove electrical connectors -arrow- on both sides from bracket and unplug connectors.



Note

Disregard -item 1-.

- Raise engine until engine mountings are clear.
- Tighten spindle of support bracket - 10 - 222 A- further.



Caution

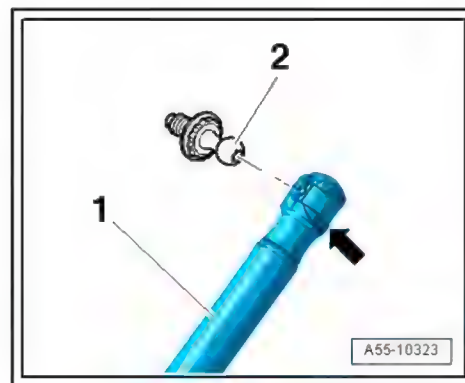
Danger of damage to hoses, pipes and wiring connections and to engine compartment.

- ♦ *Check that all hoses and wiring connections between engine, gearbox, subframe and body have been detached.*
- ♦ *Carefully guide engine out of engine compartment when lifting out.*

i Note

A second mechanic is required to carefully open bonnet as much as possible when lifting engine out.

- Use small screwdriver to slightly lift retaining clip -arrow- at both ends and detach gas strut -1- from ball stud -2- at top.
- Separate engine from gearbox and lift engine out of engine compartment.
- Press gas struts back onto ball studs.



1.2 Securing engine to engine and gearbox support

When carrying out repairs, secure engine to engine and gearbox support - VAS 6095A- using universal support - VAS 6095/1- .

Special tools and workshop equipment required

- ◆ Engine and gearbox support - VAS 6095A-



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- ◆ Workshop hoist - VAS 6100-



- ◆ Lifting tackle - 3033-



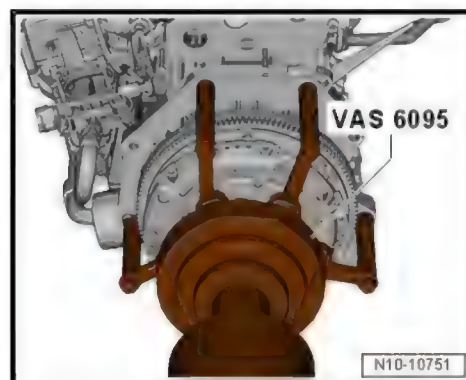
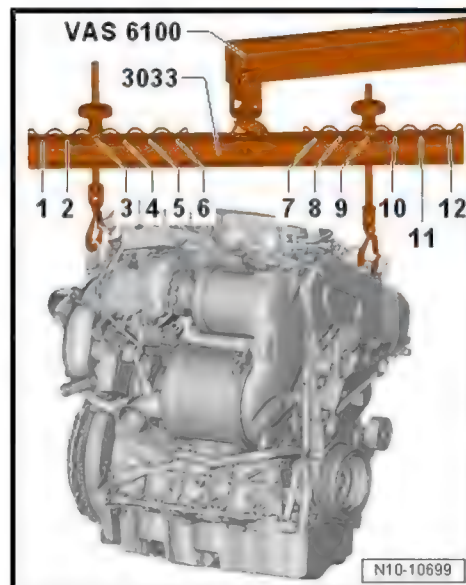


Procedure

- Gearbox detached from engine.
- Attach lifting tackle - 3033- to engine and workshop hoist - VAS 6100- as shown in illustration.
- ◆ Gearbox end: position 3.
- ◆ Pulley end: position 9.
- Lift engine off engine bracket - T10497A- using workshop hoist - VAS 6100- .
- Secure engine to engine and gearbox support - VAS 6095A- using universal support - VAS 6095/1- .

Tightening torque

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65



1.3 Installing engine

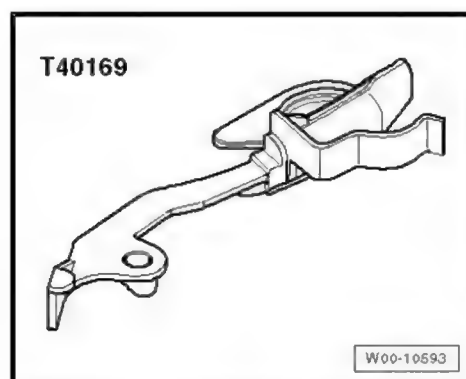
When installing a new base engine, you must check whether there is a sticker on the cylinder head cover.

If a sticker is attached which states **Spannpratzen auf vorgeschriebenes Drehmoment angezogen** (clamping pieces tightened to specified torque), the clamping pieces have already been tightened to the specified final torque at the factory.

If no sticker is attached, it is essential that the clamping pieces for the injectors are tightened to the specified torque ⇒ [Item 7 \(page 237\)](#) after installing the high-pressure pipes. If these instructions are not observed, the engine could be damaged.

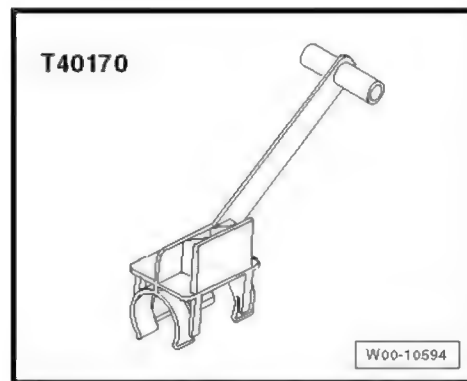
Special tools and workshop equipment required

- ◆ Assembly aid - T40169-





◆ Transportation lock - T40170-



Tightening torques



Note

- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- ◆ *Do not use de-greased parts.*
- ◆ *Tolerance for tightening torques: $\pm 15\%$*

Component		Nm
Bolts/nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65

- ◆ *⇒ "2.1 Exploded view - assembly mountings", page 34*
- ◆ *Engine to gearbox ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox or ⇒ Rep. gr. 37 ; Removing and installing gearbox; Tightening torques for gearbox*

Procedure



Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- ◆ *On vehicles with manual gearbox, a needle bearing must be fitted in the drive plate. Before installing, check whether a needle bearing is fitted. Press needle bearing into drive plate ⇒ [page 65](#).*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#).*
- ◆ *Fit all cable ties in the original positions when installing.*

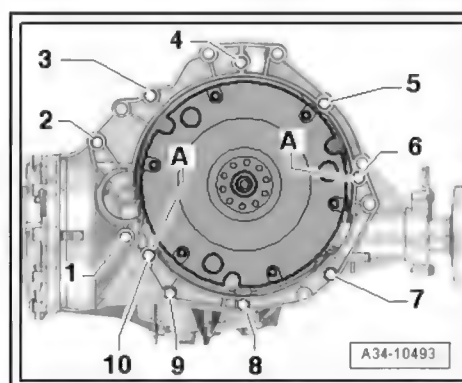
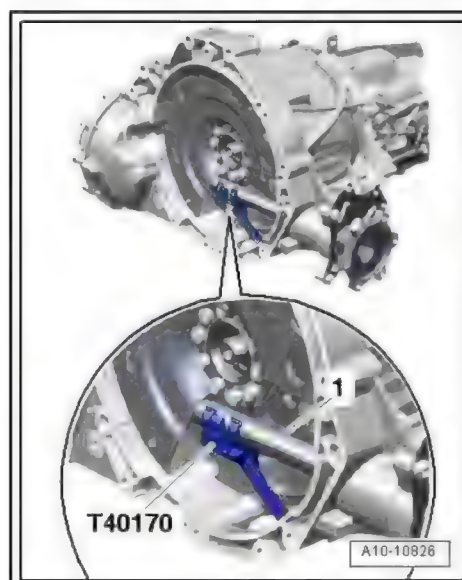
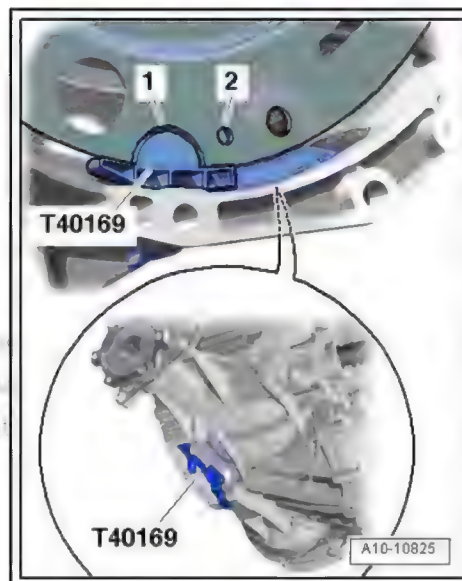
- The following preparations are required before joining engine and gearbox:
- Insert assembly aid - T40169- into gearbox housing between flywheel/torque converter and gearbox housing from below, as illustrated.
- The assembly aid must engage in the semi-circular recess -1- and in the inspection hole -2-.



Note

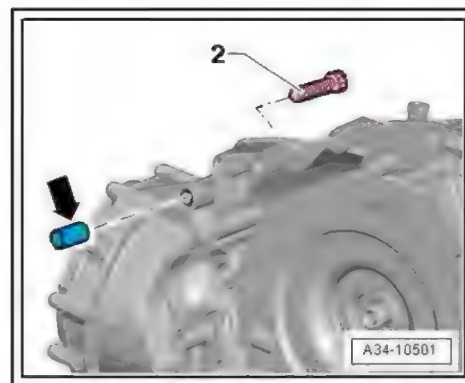
There is only one inspection hole on the circumference; turn the dual-mass flywheel accordingly.

- Insert pin of assembly aid into hole on gearbox housing.
- Insert transportation lock - T40170- into gearbox housing from below and clamp onto flange shaft -1-.
- Check whether aluminium bolts securing engine to gearbox can be reused; if so, apply marking ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox or ⇒ Rep. gr. 37 ; Removing and installing gearbox; Tightening torques for gearbox .
- Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
- Bring engine into position on gearbox, fit bolts -2 ... 6- and tighten.

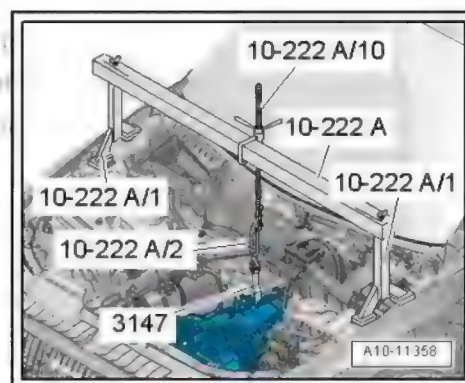


i Note

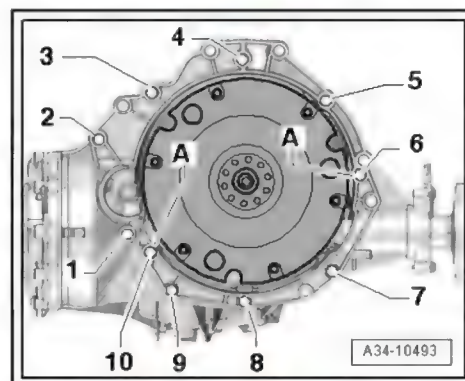
- ◆ Bolt -2- secures the starter to the gearbox and is provided with an additional spacer sleeve -arrow-.
- ◆ The spacer sleeve must be fitted between the starter and the gearbox.



- Slacken hook - 10 - 222 A /10-.
- Lower workshop hoist and place engine/gearbox assembly onto engine mountings.
- Secure engine mounting ⇒ [page 34](#) .
- Detach workshop hoist - VAS 6100- and lifting tackle - 2024 A- .



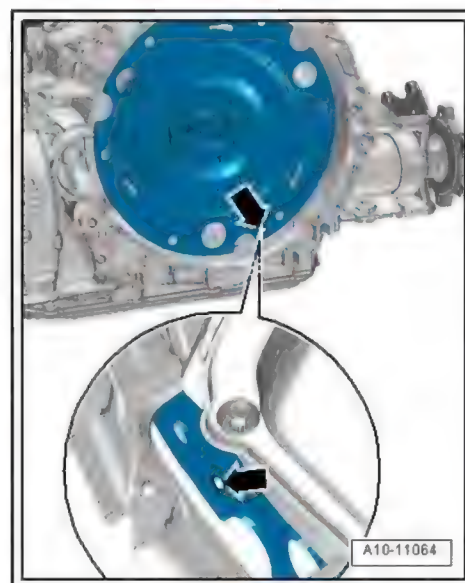
- Tighten bolts -1, 7, 8, 9, 10- to secure engine to gearbox.
- Remove transport lock - T40170- and assembly aid - T40169- .



i Note

The following step is necessary to ensure that the clutch module is straight and that it makes even contact with the drive plate.

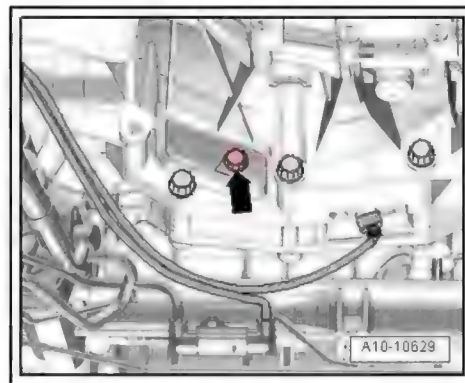
- Install wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Fit front wheels ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres .
- Engage 4th gear and turn front wheels in direction of travel until clutch module is rotated by one complete turn (360°).
- The inspection hole -arrow- should be visible again in the recess on the gearbox housing.



- Bolt clutch module onto drive plate as follows:
- Screw in first bolt -arrow- hand-tight (2 Nm).
- Turn front wheels in direction of travel until clutch module is rotated by 240°.
- Tighten bolt accessible in this position to specified torque ⇒ Rep. gr. 30 ; Clutch; Exploded view - clutch module .
- Turn front wheels in direction of travel until clutch module is rotated by 120° each time and tighten remaining 2 bolts to specified torque ⇒ Rep. gr. 30 ; Clutch; Exploded view - clutch .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install particulate filter ⇒ [page 281](#) .
- Install pressure differential sender - G505- ⇒ [page 282](#) .
- Install plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .
- Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 ; Windscreen washer system; Exploded view - windscreen washer system .
- Install air cleaner housing ⇒ [page 227](#) .
- Install lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Install tensioner and idler roller ⇒ [page 42](#) .
- Install vibration damper ⇒ [page 47](#) .
- Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator .
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- Install poly V-belt ⇒ [page 45](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install engine control unit ⇒ [page 269](#) .
- Install electrical wiring, terminal 30 wiring junction 2 - TV22- and cover for electronics box in engine compartment ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronic boxes; Overview of fitting locations - relay carriers, fuse carriers, electronic boxes .
- Install cross member and torque reaction support ⇒ [page 38](#) .
- Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .



Caution

Risk of irreparable damage to control units because of excessive voltage.

- ◆ *Never use battery charging equipment for boost starting.*



- Install air hoses with screw-type clips ⇒ [page 209](#) .
- Check oil level ⇒ Maintenance ; Booklet 411 .
- Bleed fuel system
⇒ "1.3 Filling and bleeding fuel system", [page 222](#) .
- Connect coolant hoses with plug-in connector ⇒ [page 190](#) .



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .
- Install wheel spoilers ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Install noise insulation panels ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



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2 Assembly mountings

⇒ "2.1 Exploded view - assembly mountings", page 34

⇒ "2.2 Supporting engine in installation position", page 36

⇒ "2.3 Removing and installing engine mountings", page 37

⇒ "2.4 Removing and installing torque reaction support and cross member", page 38

⇒ "2.5 Removing and installing gearbox mounting", page 39

2.1 Exploded view - assembly mountings

Engine mounting

1 - Bolt

- 20 Nm

2 - Bracket

- For engine mounting
- Renew retaining plate if engine mounting is defective
- Check retaining plate on opposite side; renew if necessary

3 - Bolt

- 40 Nm

4 - Engine support

5 - Bolt

- 10 Nm

6 - Heat shield

- Right-side only

7 - Bolt

- Renew
- 90 Nm +90°

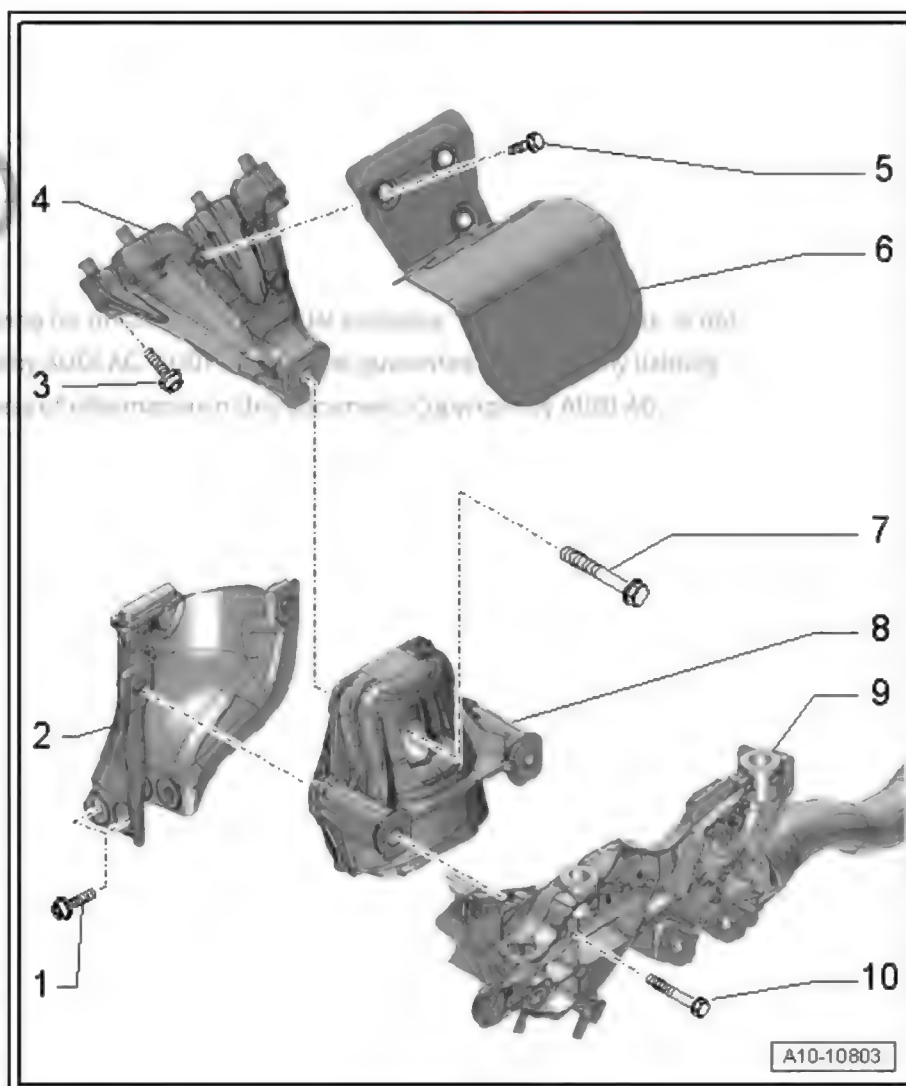
8 - Engine mounting

- Left side: with left electrohydraulic engine mounting solenoid valve - N144-
- Right side: with right electrohydraulic engine mounting solenoid valve - N145-
- Removing and installing
⇒ [page 37](#)
- Renew in pairs

9 - Subframe

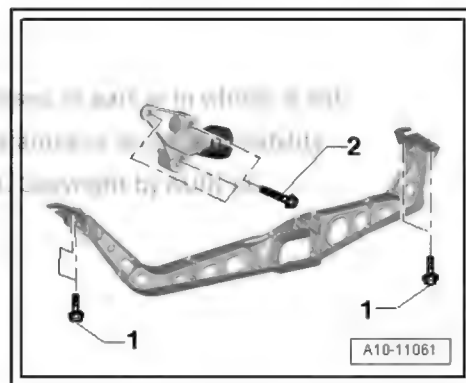
10 - Bolt

- 55 Nm



Torque reaction support and cross member - tightening torques

- 1 - Bolt, 25 Nm
- 2 - Bolt, 40 Nm



Gearbox mounting for manual gearbox

1 - Nut

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

2 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

3 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

4 - Nut

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

5 - Gearbox support

- ☐ Removing and installing ⇒ [page 39](#)

6 - Gearbox mounting

- ☐ Removing and installing ⇒ [page 39](#)

7 - Stop (bottom)

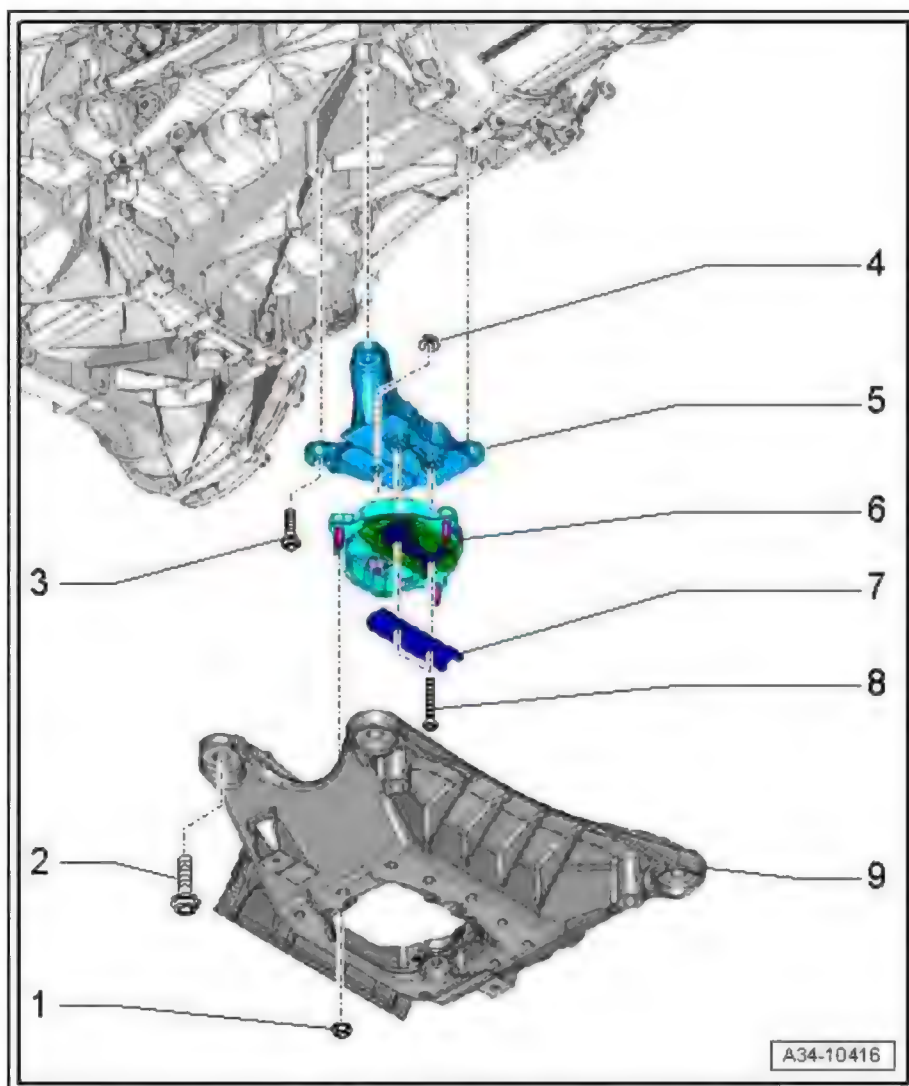
- ☐ For gearbox mounting

8 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings

9 - Tunnel cross member

- ☐ Removing and installing ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings



Gearbox mounting for multitronic gearbox

1 - Nut

- ❑ Tightening torque ⇒
Rep. gr. 37 ; Assembly
mountings; Exploded
view - assembly mount-
ings

2 - Bolt

- ❑ Tightening torque ⇒
Rep. gr. 37 ; Assembly
mountings; Exploded
view - assembly mount-
ings

3 - Bolt

- ❑ Tightening torque ⇒
Rep. gr. 37 ; Assembly
mountings; Exploded
view - assembly mount-
ings

4 - Nut

- ❑ Tightening torque ⇒
Rep. gr. 37 ; Assembly
mountings; Exploded
view - assembly mount-
ings

5 - Gearbox support

6 - Gearbox mounting

- ❑ Removing and installing
⇒ [page 40](#)

7 - Stop (bottom)

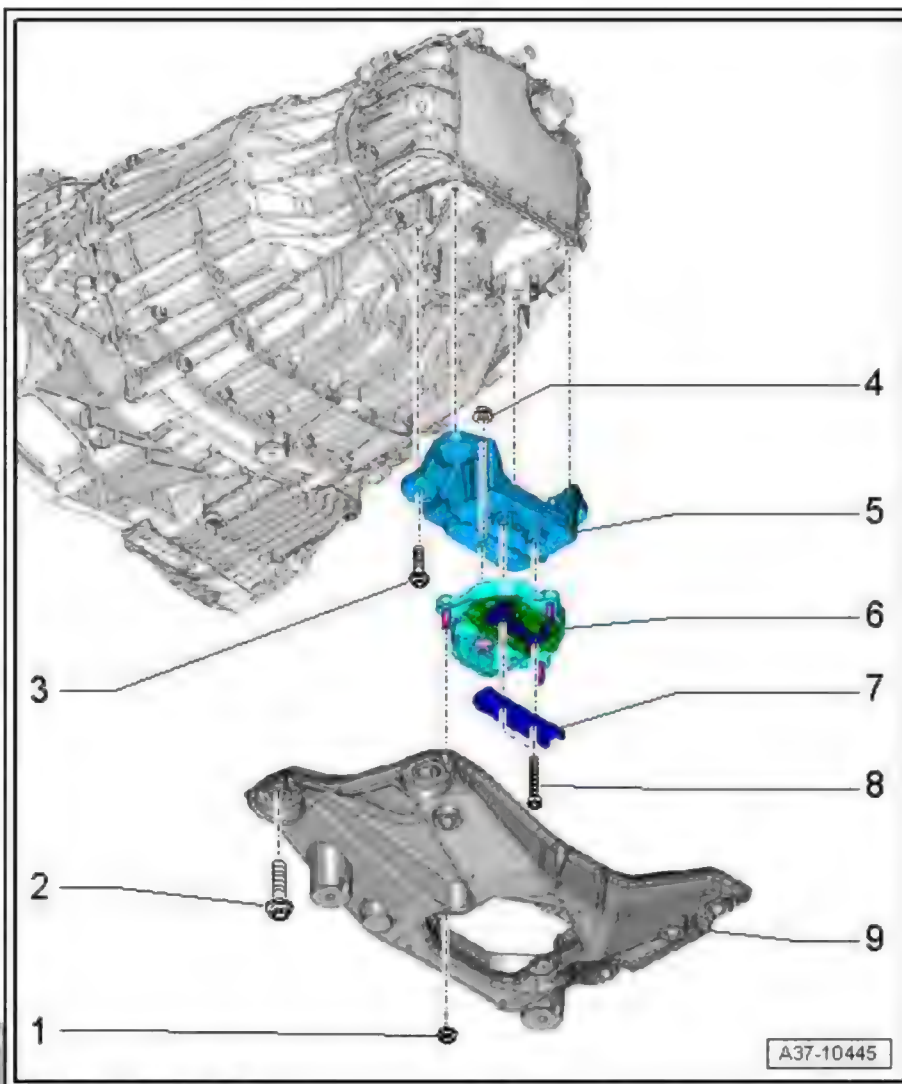
- ❑ For gearbox mounting

8 - Bolt

- ❑ Tightening torque ⇒
Rep. gr. 37 ; Assembly
mountings; Exploded
view - assembly mountings

9 - Tunnel cross member

- ❑ Removing and installing ⇒ Rep. gr. 37 ; Assembly mountings; Exploded view - assembly mountings



2.2 Supporting engine in installation position

Special tools and workshop equipment required

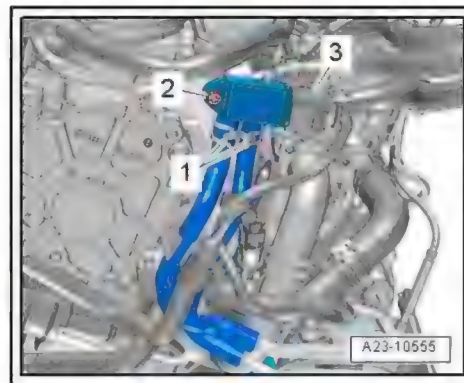
- ◆ Support bracket - 10 - 222 A-



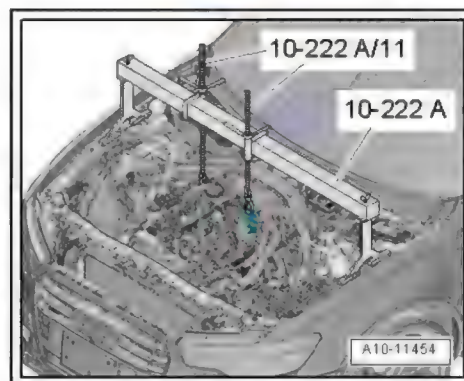


Procedure

- Remove engine cover panel ➔ [page 41](#) .
- Unplug electrical connector -3- for pressure differential sender - G505- .
- Remove bolt -2- and move hoses -1- clear at bracket.
- Move pressure differential sender - G505- to rear.



- Set up support bracket - 10 - 222 A- on suspension turrets (left and right) as illustrated.
- Attach spindles -10 - 222 A /11- to engine lifting eyes.
- Partly take up weight of engine with spindles.



2.3 Removing and installing engine mountings



Note

- ◆ *To avoid repeat repairs, proceed as follows if an engine mounting is defective:*
- ◆ *Renew engine mounting and corresponding retaining plate.*
- ◆ *Also renew engine mounting on opposite side; check corresponding bracket and renew if necessary.*

Removing

- Support engine in installation position ➔ [page 36](#) .
- Remove front wheels ➔ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres
- Remove wheel spoilers (front) on both sides ➔ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Remove drive shaft cover on both sides ➔ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Remove noise insulation (front) ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

- Move clear and unplug electrical connector -3- for electrohydraulic engine mounting solenoid valve.
- Remove bolts -1, 4, 5- for engine mounting.
- Detach bracket -2- and engine mounting.

Installing

Installation is carried out in reverse order; note the following:



Note

Renew the bolts tightened with specified tightening angle.

- Install pressure differential sender - G505- ➔ [page 282](#) .

Tightening torques

- ◆ ➔ ["2.1 Exploded view - assembly mountings", page 34](#)
- ◆ Drive shaft covers, wheel spoilers ➔ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)
- ◆ ➔ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres

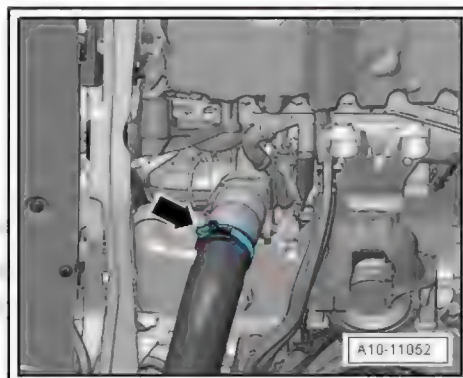
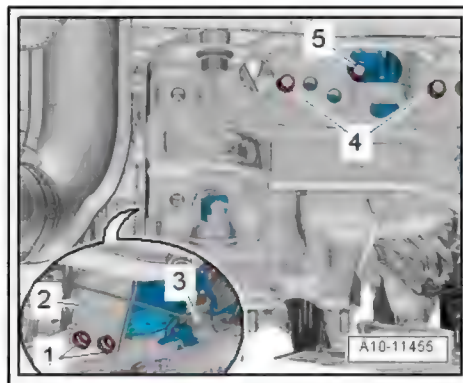
2.4 Removing and installing torque reaction support and cross member

Removing

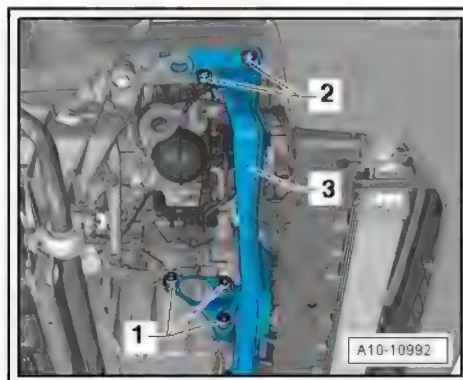
- Remove noise insulation (front) ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Release hose clip -arrow-, disconnect air hose and press to one side.



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- Move electrical wiring harness clear.
- Remove bolts -1- and detach torque reaction support.
- Remove bolts -2- on both sides and detach cross member -3-.



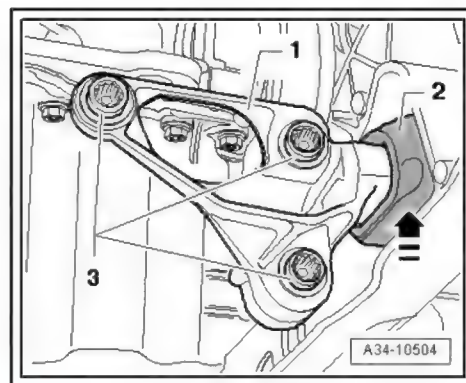
Installing

- Push torque reaction support -1- upwards -arrow- until it makes contact with cross member.
- The buffer stop -2- must be free of stress and must lie against the cross member without play.
- Tighten bolts -3- in this position.

The remaining installation steps are carried out in the reverse sequence.

Tightening torques

- ◆ ⇒ [Fig. ""Torque reaction support and cross member - tightening torques""](#), page 35
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system"](#), page 209
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



2.5 Removing and installing gearbox mounting

⇒ ["2.5.1 Removing and installing gearbox support with gearbox mounting - vehicles with manual gearbox"](#), page 39

⇒ ["2.5.2 Removing and installing gearbox mounting - vehicles with manual gearbox"](#), page 39

⇒ ["2.5.3 Removing and installing gearbox mounting - vehicles with multitronic gearbox"](#), page 40

2.5.1 Removing and installing gearbox support with gearbox mounting - vehicles with manual gearbox

Removing

- Remove tunnel cross-piece ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings .
- Remove bolts -arrows- and detach gearbox support and gearbox mounting from gearbox.

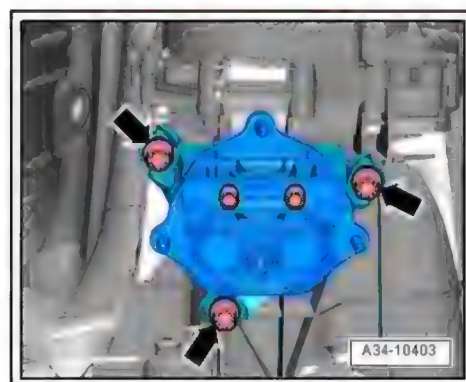
Installing

Installation is carried out in reverse order; note the following:

- Secure gearbox support with gearbox mounting to gearbox -arrows-.
- Install tunnel cross-piece ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings .

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - assembly mountings"](#), page 34



2.5.2 Removing and installing gearbox mounting - vehicles with manual gearbox

Removing

- Remove gearbox support with gearbox mounting ⇒ [page 39](#) .

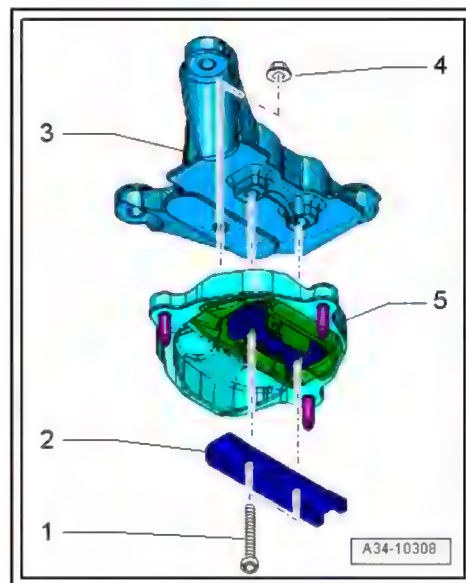
- Unscrew bolts -1- and detach stop (bottom) -2- for gearbox mounting.
- Remove nut -4- and detach gearbox mounting -5- from gearbox support -3-.

Installing

- Position gearbox support -3- on gearbox mounting -5- and hand-tighten nut -4-.
- Secure stop (bottom) -2- with bolts -1-.
- Tighten nut -4-.
- Install gearbox support with gearbox mounting ➔ [page 39](#) .

Tightening torques

- ◆ ➔ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings



2.5.3 Removing and installing gearbox mounting - vehicles with multitronic gearbox

Removing

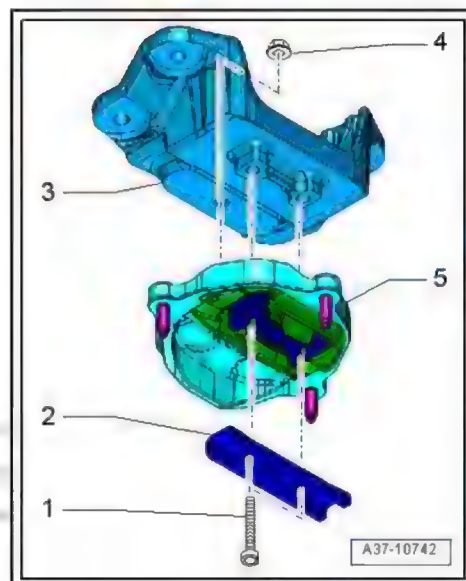
- Remove tunnel cross-piece ➔ Rep. gr. 37 ; Assembly mountings; Exploded view - assembly mountings .
- Unscrew bolts -1- and detach stop (bottom) -2- for gearbox mounting.
- Remove nut -4- and detach gearbox mounting -5- from gearbox support -3-.

Installing

- Position gearbox support -3- on gearbox mounting -5- and hand-tighten nut -4-.
- Secure stop (bottom) -2- with bolts -1-.
- Tighten nut -4-.
- Install tunnel cross-piece ➔ Rep. gr. 37 ; Assembly mountings; Exploded view - assembly mountings .

Tightening torques

- ◆ ➔ Rep. gr. 37 ; Assembly mountings; Exploded view - assembly mountings





3 Engine cover panel

⇒ ["3.1 Removing and installing engine cover panel", page 41](#)

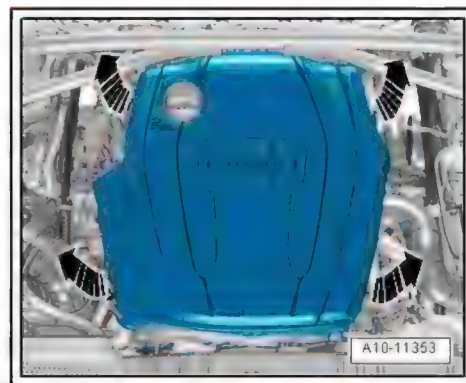
3.1 Removing and installing engine cover panel

Removing

- Carefully pull engine cover panel off retaining pins one after another -arrows-. Do not jerk engine cover panel away, and do not try to pull on one side only.

Installing

- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.
- When fitting engine cover panel, take care not to damage oil filler neck.
- First press engine cover panel onto rear rubber grommets and then onto front rubber grommets with both hands.



13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ "1.1 Exploded view - cylinder block (pulley end)", page 42

⇒ "1.2 Exploded view - sealing flange (pulley end)", page 44

⇒ "1.3 Removing and installing poly V-belt", page 45

⇒ "1.4 Removing and installing tensioner for poly V-belt", page 47

⇒ "1.5 Removing and installing vibration damper", page 47

⇒ "1.6 Removing and installing bracket for ancillaries", page 48

⇒ "1.7 Renewing crankshaft oil seal (pulley end)", page 49

⇒ "1.8 Removing and installing sealing flange (pulley end)", page 51

1.1 Exploded view - cylinder block (pulley end)

1 - Poly V-belt

- ☐ Check for wear
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
- ☐ Removing and installing ⇒ page 45
- ☐ When installing, make sure it is properly seated on pulleys.

2 - Bolt

- ☐ Renew
- ☐ 10 Nm +90°

3 - Cap

- ☐ For vibration damper

4 - Vibration damper

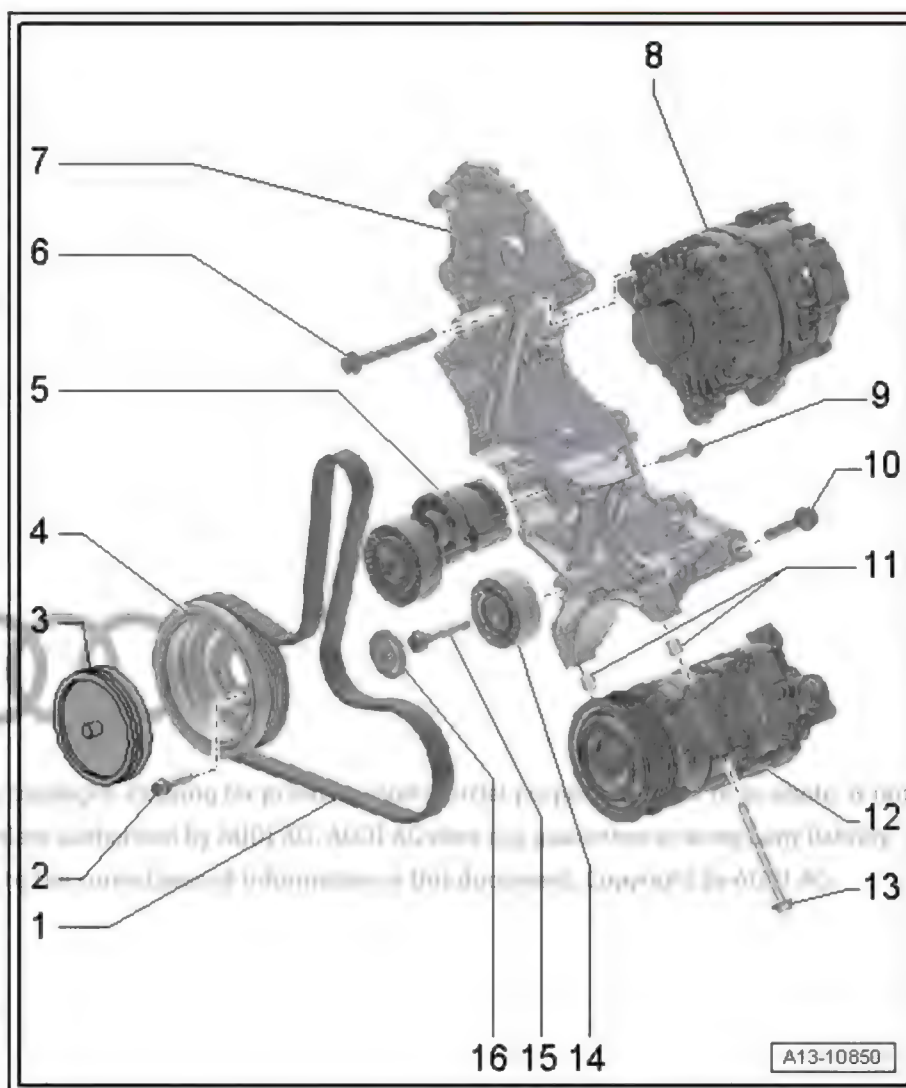
- ☐ Can only be installed in one position
- ☐ Removing and installing ⇒ page 47

5 - Tensioner

- ☐ For poly V-belt
- ☐ Use locking tool - T40098- to lock tensioner.
- ☐ Removing and installing ⇒ page 47

6 - Bolt

- ☐ Tightening torque ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator





7 - Bracket

- ☐ For ancillaries
- ☐ Removing and installing ⇒ [page 48](#)

8 - Alternator

- ☐ Removing and installing ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator

9 - Bolt

- ☐ Bolt can be re-used; tightening torque for re-used bolt: 20 Nm + 90°
- ☐ New bolt: 20 Nm +180°

10 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 44](#)

11 - Dowel sleeve

- ☐ Ensure correct seating in bracket

12 - Air conditioner compressor

- ☐ Do not unscrew or disconnect refrigerant hoses or pipes.
- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket
- ☐ Pay attention to dowel sleeves ⇒ [Item 11 \(page 43\)](#) when installing

13 - Bolt

- ☐ Tightening torque ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

14 - Idler roller

- ☐ For poly V-belt
- ☐ Note installation position

15 - Bolt

- ☐ Renew
- ☐ 20 Nm +90°

16 - Cap

- ☐ For idler roller

Bracket for ancillaries - tightening torque and tightening sequence

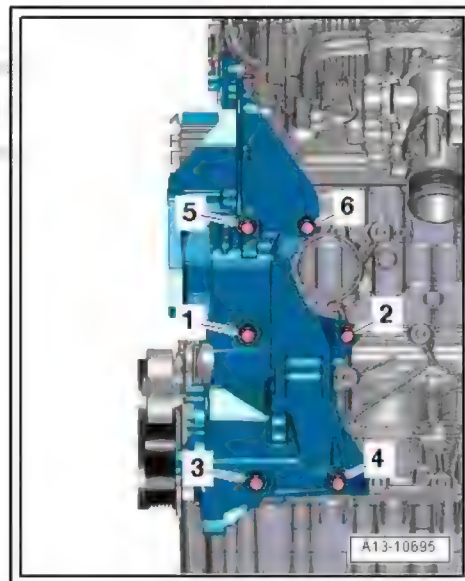


Note

Renew the bolts tightened with specified tightening angle.

- Fit bolts in the following sequence:
 - ◆ Bolts -1, 5, 6- M10x60.
 - ◆ Bolt -2- M10x40
 - ◆ Bolts -3, 4- M10x155.
- Tighten bolts in 5 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	40 Nm
3.	-1- and -2-	Turn 60° further
4.	-3- and -4-	Turn 180° further
5.	-5- and -6-	Turn 60° further



1.2 Exploded view - sealing flange (pulley end)



1 - Bolt

- ☐ Tightening torque
⇒ [Item 27 \(page 82\)](#)

2 - Crankshaft sprocket

- ☐ Contact surface between sprocket and crankshaft must be free of oil
- ☐ Can only be installed in one position

3 - Oil seal

- ☐ For crankshaft (pulley end)
- ☐ Renewing ⇒ [page 49](#)
- ☐ Do not lubricate with oil

4 - Sealing flange (pulley end)

- ☐ Should be positioned on dowel pins
- ☐ Removing and installing
⇒ [page 51](#)

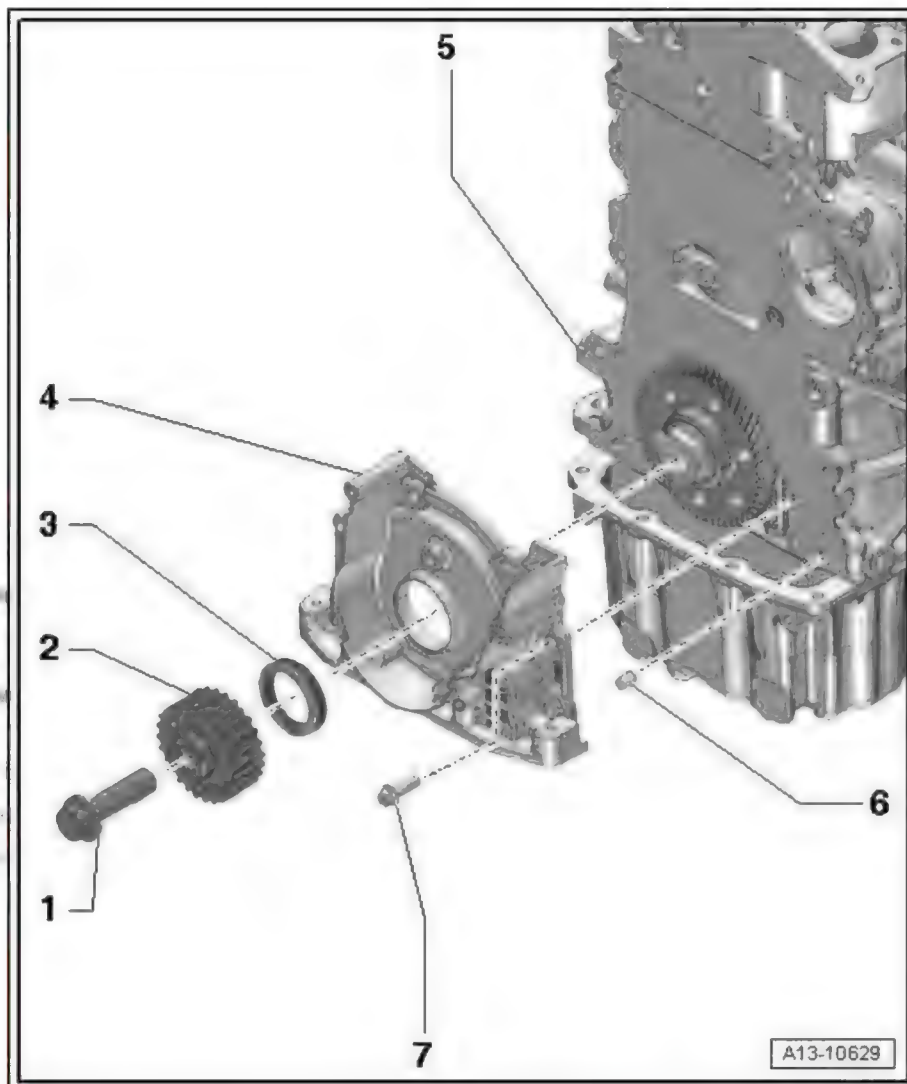
5 - Cylinder block

6 - Dowel pin

- ☐ 2x

7 - Bolt

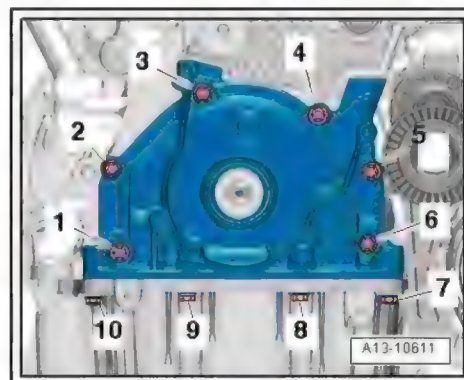
- ☐ Tightening torque and sequence ⇒ [page 45](#)



Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts in 3 stages in the sequence shown:

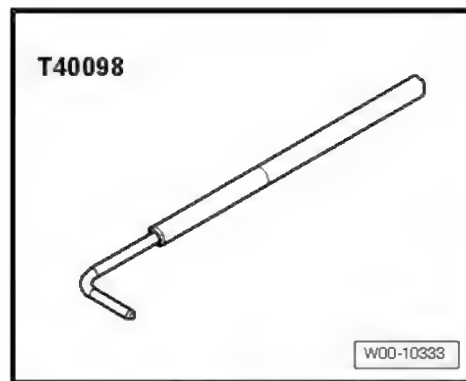
Stage	Bolts	Tightening torque
1.	-1 ... 10-	Screw in by hand until contact is made
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 15 Nm
3.	-7 ... 10-	15 Nm



1.3 Removing and installing poly V-belt

Special tools and workshop equipment required

◆ Locking tool - T40098-



Removing

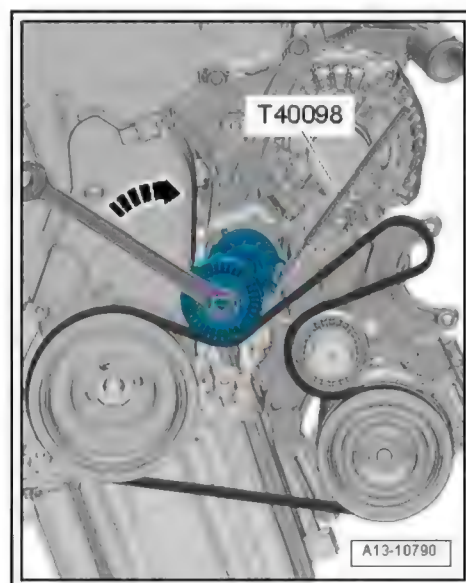


Caution

Running a used poly V-belt in the opposite direction could cause irreparable damage.

- ◆ *Before removing the poly V-belt, mark the direction of rotation with chalk or a felt-tip pen for re-installation.*

- Swivel tensioner in clockwise direction -arrow-, detach poly V-belt from alternator pulley and lock tensioner using locking tool - T40098- .
- Take off poly V-belt.



Installing

Installation is carried out in reverse order; note the following:

- Fit poly V-belt on poly V-belt pulleys:

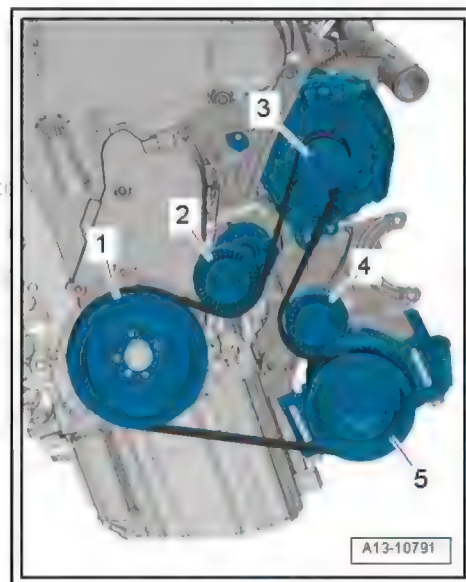
- 1 - Vibration damper
- 2 - Idler roller
- 3 - Poly V-belt tensioner
- 4 - Alternator
- 5 - Air conditioner compressor



Note

When installing poly V-belt, make sure it is properly seated on pulleys.

- Start engine and check that poly V-belt(s) run properly.





1.4 Removing and installing tensioner for poly V-belt

Removing

- Remove poly V-belt ⇒ [page 45](#) .
- Release hose clips -arrows- and remove air hose.



Note

Disregard -item 1-.

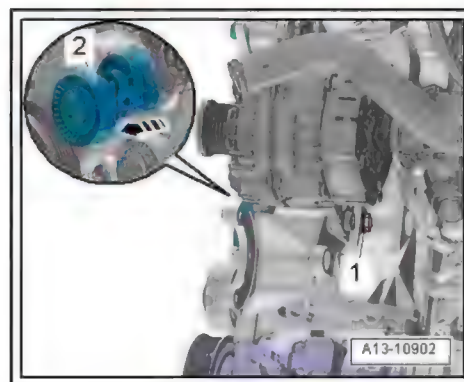


- Remove bolt -1- and detach poly V-belt tensioner -2-.



Note

- ◆ If bolt -1- makes contact with engine bracket, leave bolt in installation position.
- ◆ Due to lack of space, the tensioner must be guided out upwards by rotating it.



Installing

Installation is carried out in reverse order; note the following:

- Install poly V-belt ⇒ [page 45](#) .

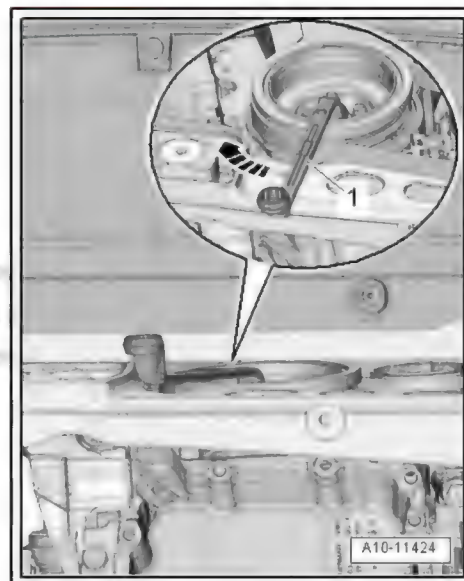
Tightening torques

- ◆ ⇒ ["1.1 Exploded view - cylinder block \(pulley end\)", page 42](#)
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system", page 209](#)

1.5 Removing and installing vibration damper

Removing

- Remove torque reaction support and cross member ⇒ [page 38](#) .
- Remove poly V-belt ⇒ [page 45](#) .
- Remove radiator fan control unit - J293- ⇒ [page 200](#) .
- Detach cap from vibration damper.
- Counterhold crankshaft on central bolt using angled ring spanner -1- when loosening bolts for vibration damper.



- Loosen bolts -arrows- for vibration damper.
- Remove bolts and take off vibration damper.

Installing

Installation is carried out in reverse order; note the following:



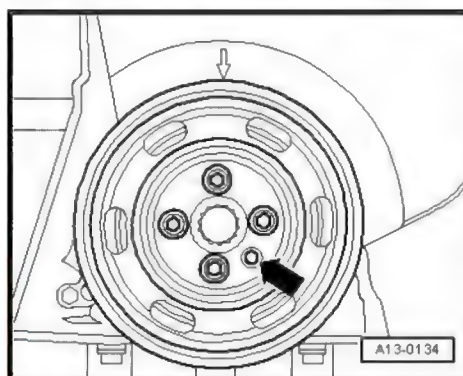
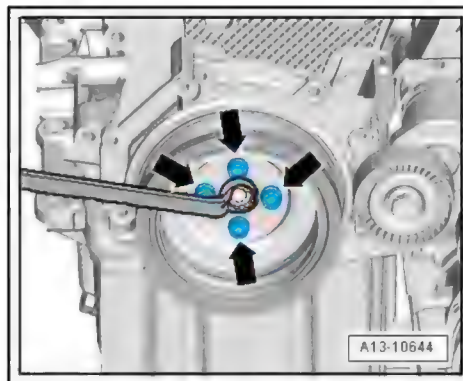
Note

Renew the bolts tightened with specified tightening angle.

- Installation position: hole -arrow- in vibration damper must be positioned over raised section of crankshaft sprocket.
- Install radiator fan control unit - J293- ➔ [page 200](#) .
- Install poly V-belt ➔ [page 45](#) .
- Install torque reaction support and cross member ➔ [page 38](#) .

Tightening torques

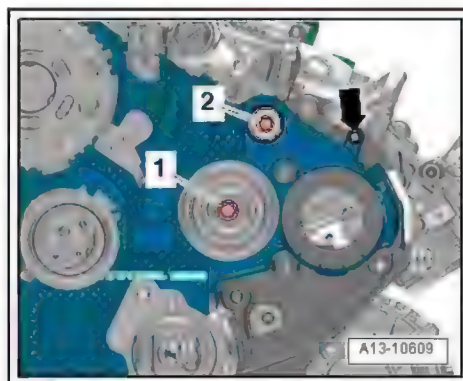
- ♦ ➔ ["1.1 Exploded view - cylinder block \(pulley end\)", page 42](#)



1.6 Removing and installing bracket for ancillaries

Removing

- Remove alternator ➔ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
- Remove high-pressure pump ➔ [page 263](#) .
- Remove 4/2-way valve ➔ [page 173](#) .
- Remove bolt -arrow-.
- Remove bolts -1- and -2- and remove idler rollers for toothed belt.





- Unplug electrical connector -1- and move wiring clear.



WARNING

Risk of injury caused by refrigerant.

- ◆ *The air conditioner refrigerant circuit must not be opened.*

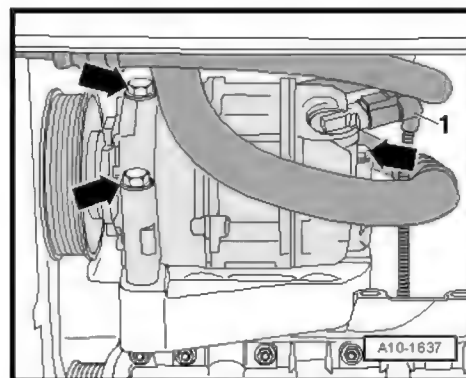
- Remove bolts -arrows- for air conditioner compressor.



Caution

Risk of damage to refrigerant lines and hoses.

- ◆ *Do NOT stretch, kink or bend refrigerant lines and hoses.*



- Tie up air conditioner compressor together with lines to one side (lines remain connected).

- Remove bolts -1 ... 6- and detach bracket for ancillaries.

Installing

Installation is carried out in reverse order; note the following:



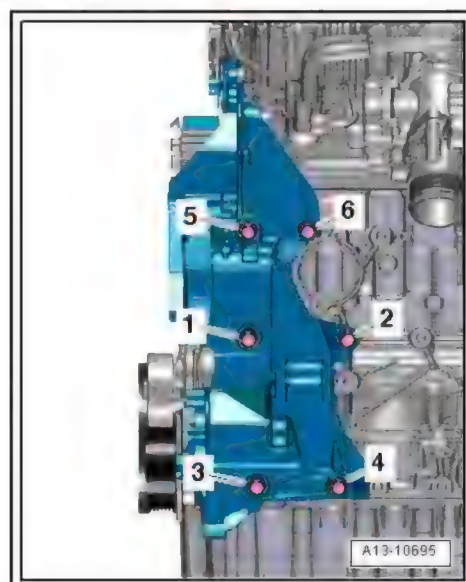
Note

Renew the bolts tightened with specified tightening angle.

- Check that dowel sleeves are fitted at top right between bracket for ancillaries and cylinder block; insert dowel sleeves if necessary.
- Tighten bolts for bracket for ancillaries ⇒ [page 44](#) .
- Install 4/2-way valve ⇒ [page 173](#) .
- Install high-pressure pump ⇒ [page 263](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 87](#) .

Tightening torques

- ◆ ⇒ Fig. "Bracket for ancillaries - tightening torque and tightening sequence", [page 44](#)
- ◆ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit
- ◆ ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator

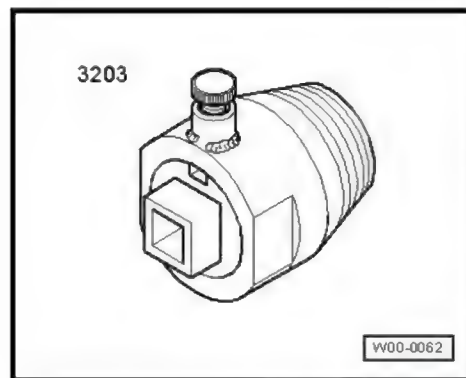


1.7 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required



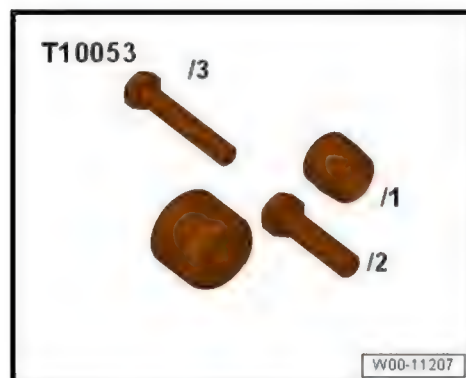
◆ Oil seal extractor - 3203-



◆ Counterhold tool - 3415-

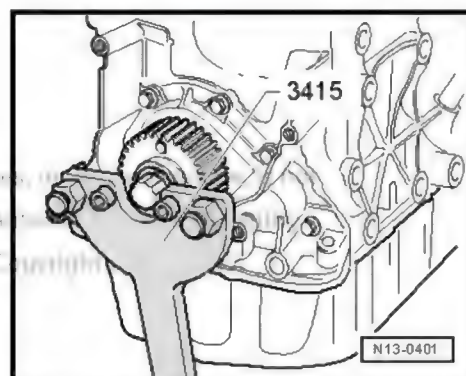


◆ Assembly tool - T10053-



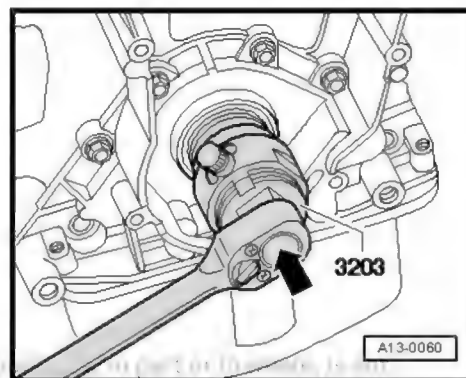
Procedure

- Remove toothed belt ➔ [page 83](#) .
- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
- Remove bolt and detach crankshaft sprocket.





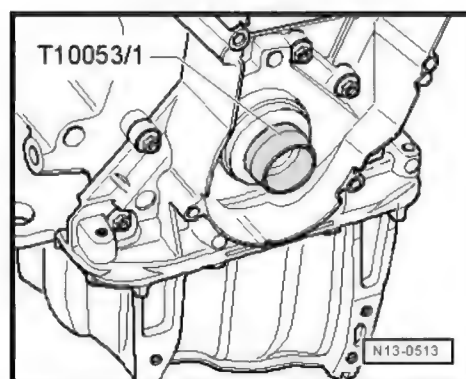
- Adjust inner section of oil seal extractor -3203- so it is flush with the outer section and lock in position with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface for oil seal.
- Remove oil residue from crankshaft journal with a clean cloth.



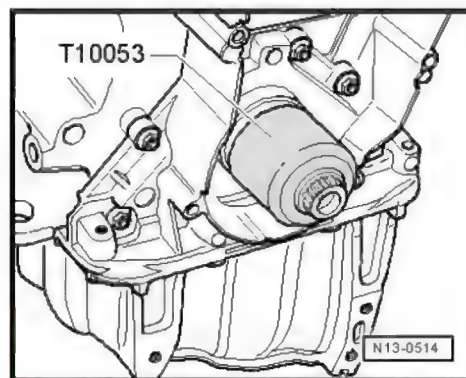
Note

Do not lubricate sealing lip and outer rim of oil seal before pressing in.

- Fit guide sleeve -T10053/1- onto crankshaft journal.
- Push oil seal over guide sleeve onto crankshaft journal.



- Press in oil seal using bolt for crankshaft sprocket and thrust sleeve of assembly tool - T10053- until flush.
- Install crankshaft sprocket ➔ [page 81](#) .
- Install toothed belt (adjust valve timing) ➔ [page 87](#) .



1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

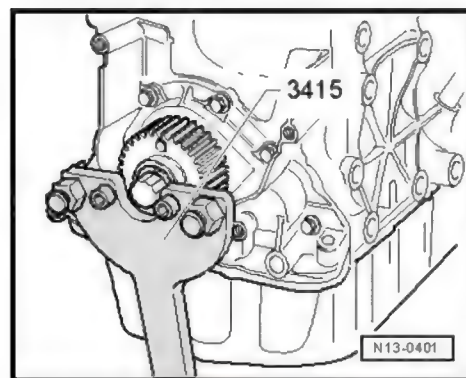
◆ Counterhold tool - 3415-



- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

- Remove toothed belt ⇒ [page 83](#) .
- Loosen bolt for crankshaft sprocket using counterhold tool - 3415- .
- Remove bolt and detach crankshaft sprocket.



- Remove bolts -1 ... 10- and carefully release sealing flange from bonded joint.
- Drive out oil seal with sealing flange removed.

Installing

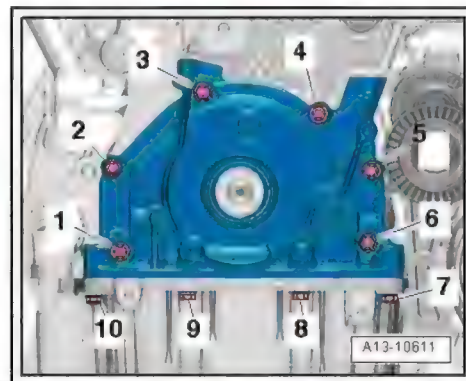
Installation is carried out in reverse order; note the following:



Caution

Make sure sealant residue does not enter lubrication system.

- ◆ *Place a clean cloth over the exposed section of the sump.*



- Carefully remove sealant residue on cylinder block and sump.

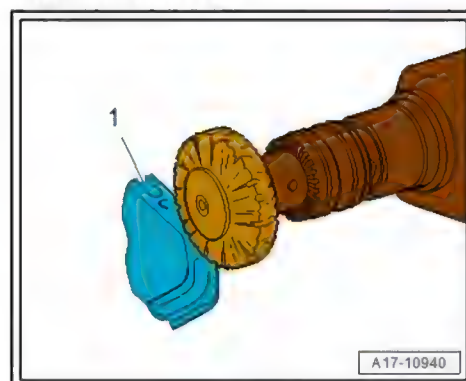


WARNING

Risk of eye injury.

- ◆ *Put on safety goggles.*

- Use e.g. rotating plastic brush to remove sealant residue on sealing flange.
- Clean sealing surfaces; they must be free of oil and grease.

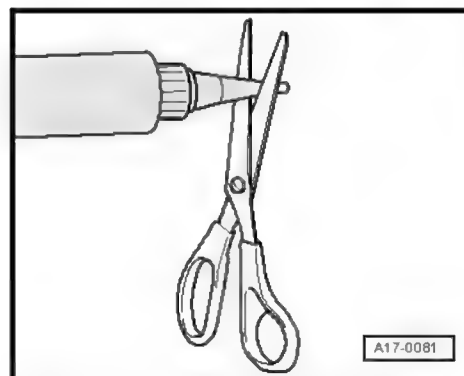




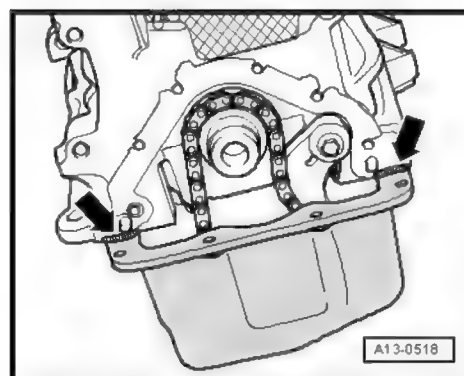
i Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



- Apply a thin bead of sealant at the edge of the joint between the cylinder block and the sump -arrows-.

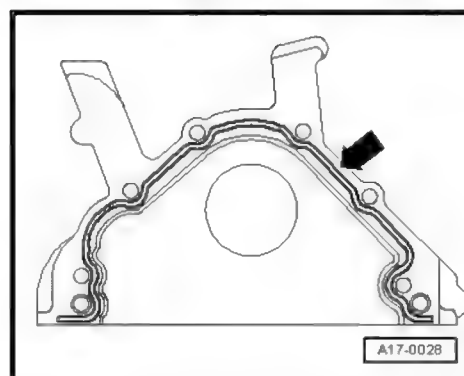


Caution

Make sure lubrication system is not clogged by excess sealant.

- ♦ *The sealant bead must not be thicker than specified.*

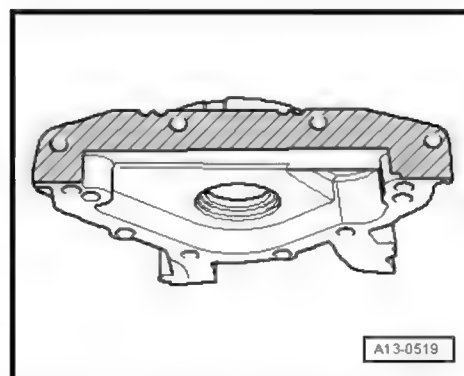
- Apply sealant bead -arrow- onto clean sealing surface of sealing flange as shown in illustration.
- Thickness of sealant bead: 2 ... 3 mm
- Apply a thin coat of sealant to bottom sealing surface -shaded- on sealing flange.



i Note

The sealing flange must be installed within 5 minutes after applying the sealant.

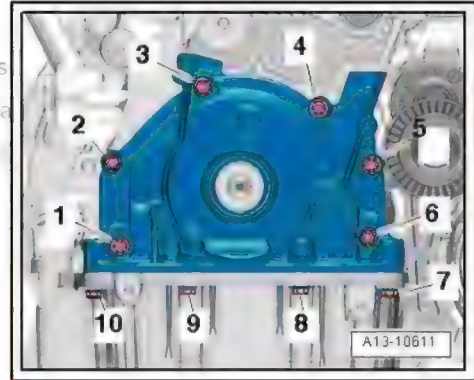
- Carefully fit sealing flange onto dowel pins in cylinder block.



- Tighten sealing flange bolts ⇒ [page 45](#) .
- Install crankshaft oil seal (pulley end) ⇒ [page 49](#) .

Tightening torques unless authorised by AUDI AG. AUDI AG does not guarantee

- ♦ ⇒ ["1.2 Exploded view - sealing flange \(pulley end\)", page 44](#)





2 Cylinder block (gearbox end)

⇒ "2.1 Exploded view - cylinder block (gearbox end)", page 55

⇒ "2.2 Removing and installing drive plate", page 56

⇒ "2.3 Removing and installing sealing flange (gearbox end)", page 57

⇒ "2.4 Renewing needle bearing in drive plate", page 65

2.1 Exploded view - cylinder block (gearbox end)

1 - Cylinder block

2 - Dowel pins

3 - Engine speed sender - G28-

- ☐ Removing and installing
⇒ page 308

4 - Bolt

- ☐ Tightening torque
⇒ Item 5 (page 305)

5 - Sealing flange (gearbox end)

- ☐ With oil seal
- ☐ Renewing ⇒ page 57

6 - Bolt

- ☐ 15 Nm

7 - Drive plate

- ☐ Lock with counterhold tool - 3067- to slacken off bolts

8 - Bolt

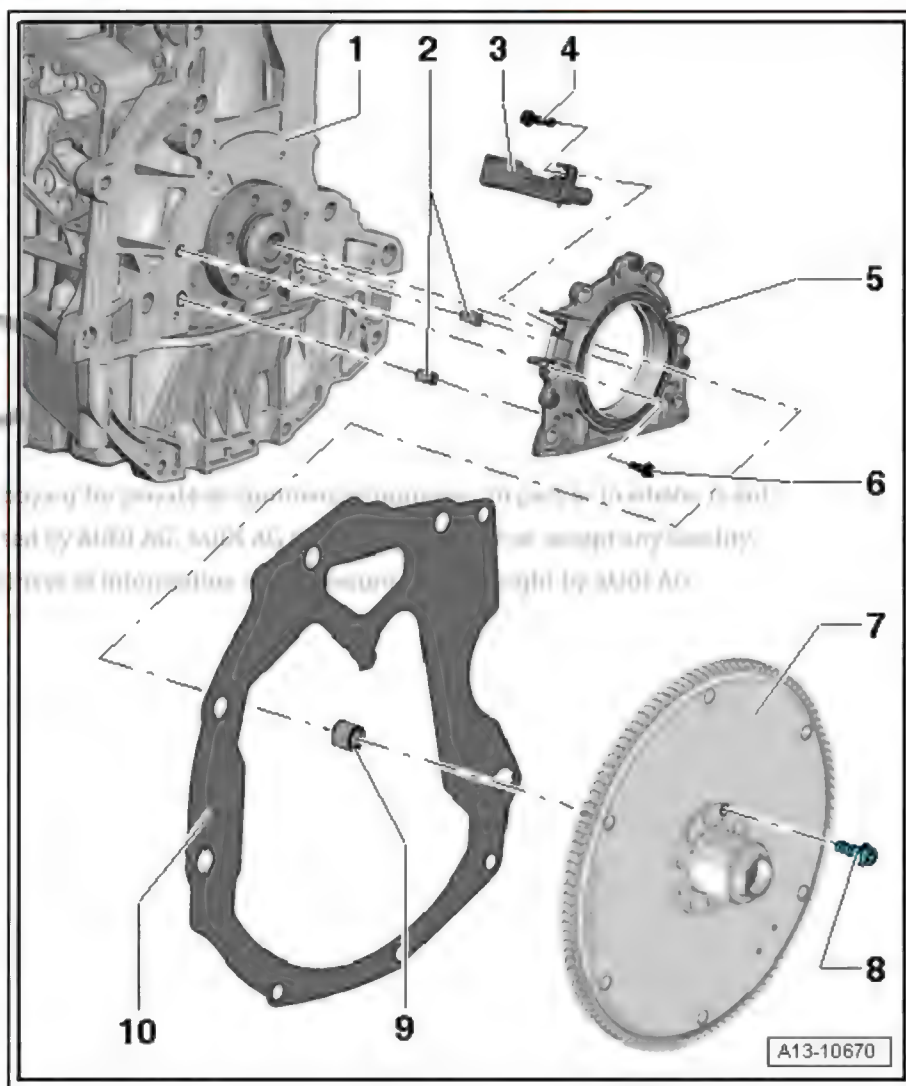
- ☐ Renew
- ☐ 60 Nm +90°

9 - Needle bearing

- ☐ For vehicles with manual gearbox
- ☐ Removing and installing
⇒ page 65

10 - Intermediate plate

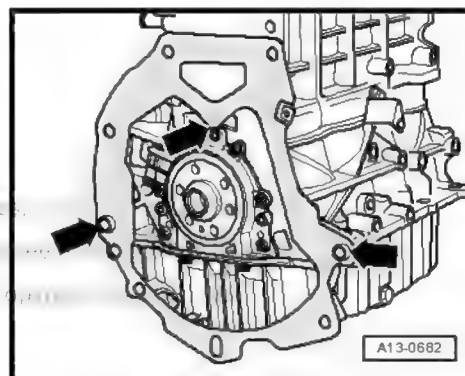
- ☐ Do not damage or bend when assembling
- ☐ Installing ⇒ page 56





Installing intermediate plate

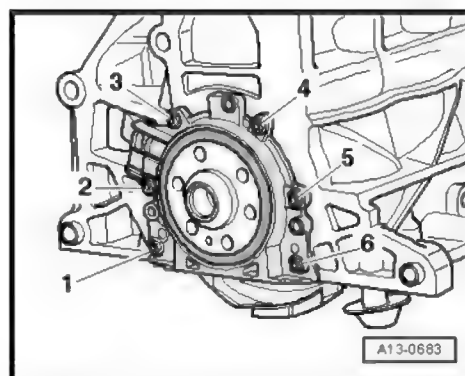
- Engage intermediate plate on sealing flange -top arrow- and push onto dowel sleeves -bottom arrows-.



Sealing flange (gearbox end) - tightening torque and sequence

- Tighten bolts in 2 stages in the sequence shown:

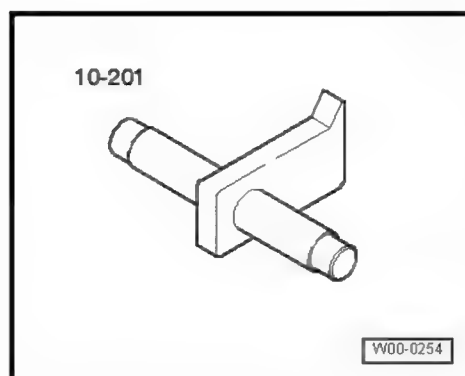
Stage	Bolts	Tightening torque
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	Tighten in stages and in diagonal sequence; final torque 15 Nm



2.2 Removing and installing drive plate

Special tools and workshop equipment required

- ♦ Counterhold tool - 10 - 201-





◆ Assembly tool - T10134-



◆ Depth gauge - VAS 6082-



◆ Bolt, M6x35 (3x)

◆ Bolt, M7x35 (2x)

Pressing out sealing flange with sender wheel

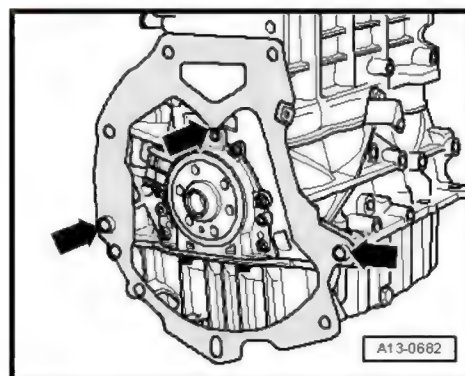
- Gearbox removed ⇒ Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox or ⇒ Rep. gr. 37 ; Removing and installing gearbox; Removing gearbox .
- Remove drive plate ⇒ [page 56](#) .
- Remove engine speed sender - G28- ⇒ [page 308](#) .



Note

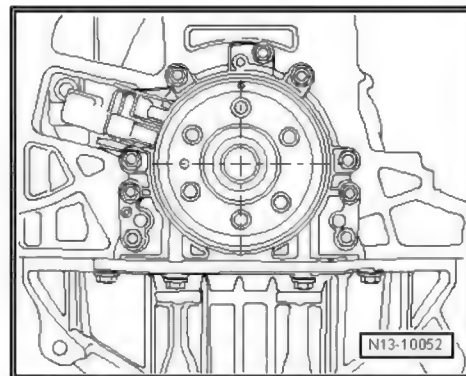
For illustration purposes, the following procedure is shown with the engine removed.

- Pull intermediate plate off dowel pins -bottom arrows- and detach from sealing flange -top arrow-.

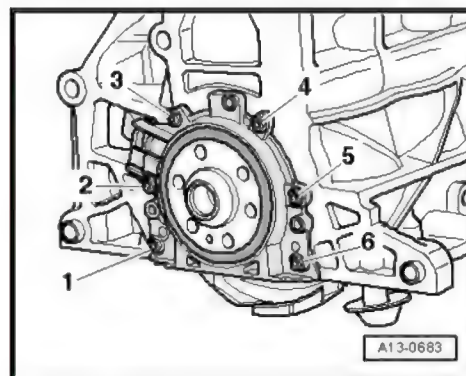




- Rotate crankshaft by turning bolt for toothed belt sprocket until crankshaft is positioned at "TDC", as shown in illustration.
- Remove sump ➔ [page 139](#) .



- Remove bolts -1 ... 6- for sealing flange.

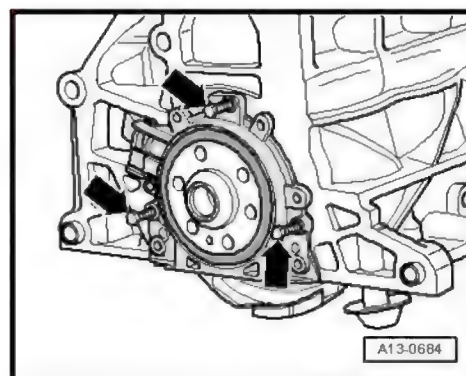


Note

The sealing flange is pressed off the crankshaft together with the sender wheel.

- To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than 1/2 turn at a time.
- Take off sealing flange with sender wheel.

Pressing in sealing flange with sender wheel



Note

- ◆ *The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.*
- ◆ *Sealing flange and sender wheel must not be separated or rotated out of position after removal from packaging.*
- ◆ *The sender wheel is held in its installation position by a locating pin on the assembly tool -T10134-.*
- ◆ *The sealing flange and oil seal are one unit and must always be replaced together with the sender wheel.*
- ◆ *The assembly tool - T10134- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.*



Construction of assembly tool - T10134-

A - Tensioning flats

B - Hexagon nut

C - Assembly housing

D - Locating pin

E - Hexagon socket-head bolt

F - Guide pin for diesel engines (black handle)

G - Guide pin for petrol engines (red handle)

A - Fitting sealing flange with sender wheel onto assembly tool - T10134- :

- Turn hexagon nut -B- on threaded spindle until it is just in front of flats -A-.

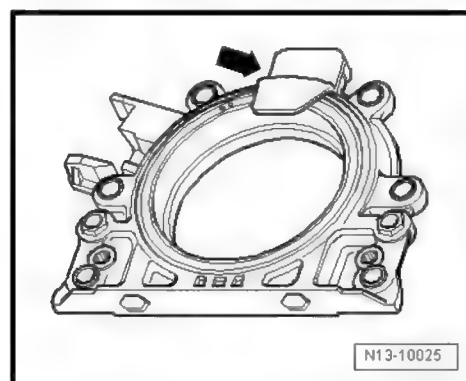
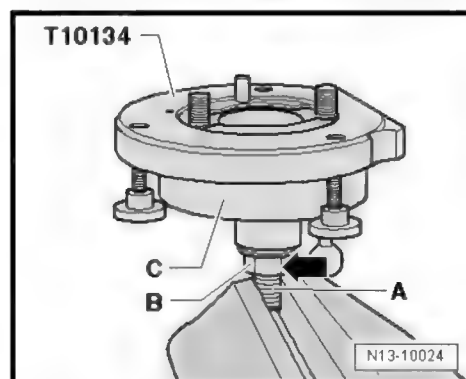
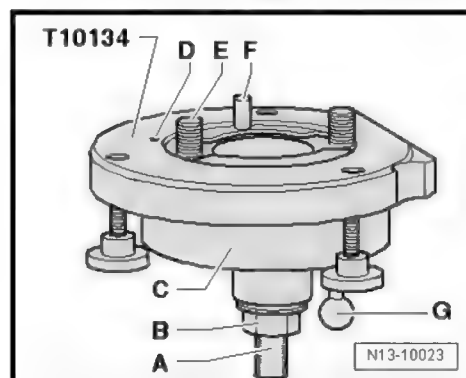
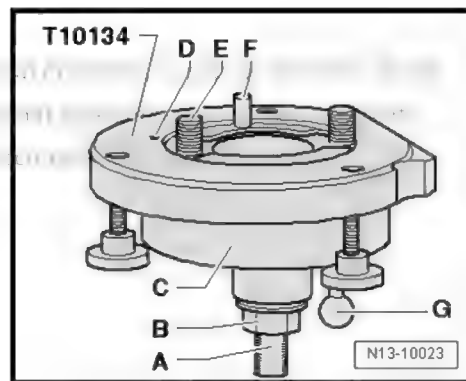
- Clamp assembly tool - T10134- in a vice on tightening flats -A- of threaded spindle.
- Press assembly housing -C- downwards so that it lies on hexagon nut -B- -arrow-.
- Inner part of assembly device and assembly housing must align (be level) with each other.

- Remove the securing clip -arrow- from new sealing flange.



Note

The sender wheel must not be taken out of the sealing flange or rotated out of position.

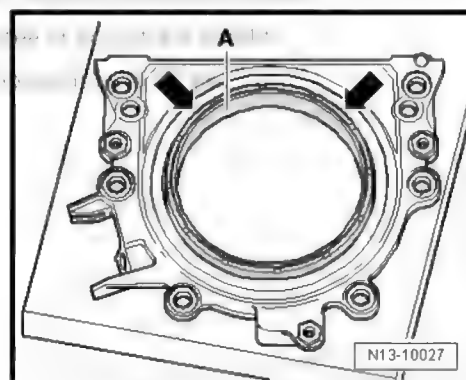
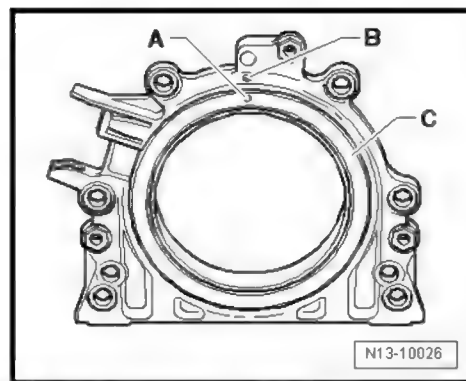




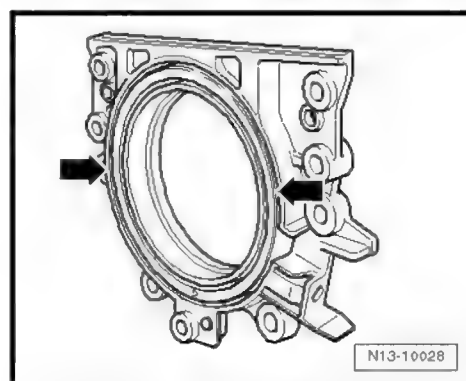
- The locating hole -A- on the sender wheel -C- must align with the marking -B- on the sealing flange.
- Place sealing flange (with front side downwards) on a clean flat surface.



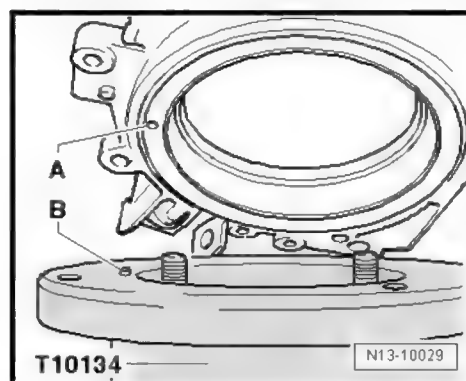
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



- The upper edge of the sender wheel and the front edge of the sealing flange must align -arrows-.

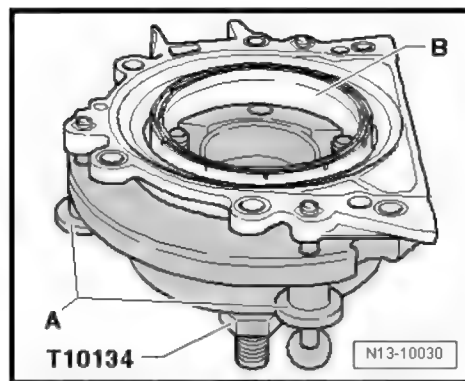


- Place front side of sealing flange on assembly tool - T10134- , so that locating pin -B- can be inserted in hole -A- in sender wheel.
- Ensure that sealing flange lies flat on assembly tool.



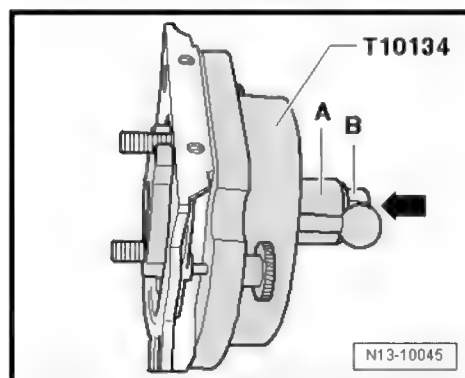


- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10134- while tightening the 3 knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.
- Ensure that the sender wheel remains fixed on the assembly tool when installing the sealing flange.

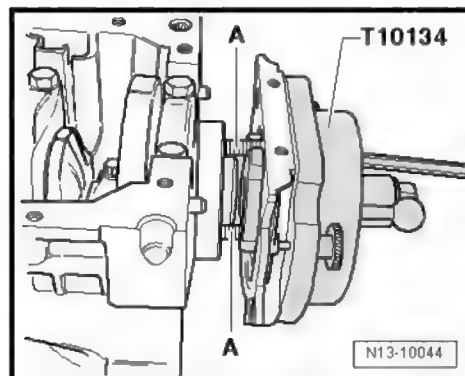


B - Installing assembly tool - T10134- with sealing flange on crankshaft flange:

- Crankshaft flange must be free of oil and grease.
- Engine is at "TDC" position.
- Screw hexagon nut -B- to end of threaded spindle.
- Press the threaded spindle of assembly tool - T10134- in direction of -arrow- until the hexagon nut -B- lies on the assembly housing -A-.



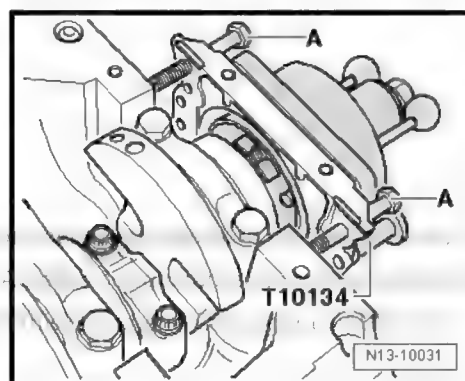
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool - T10134- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.



- Screw two bolts M7×35 mm -item A- into cylinder block to guide sealing flange.



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C - Securing assembly tool - T10134- onto crankshaft flange:

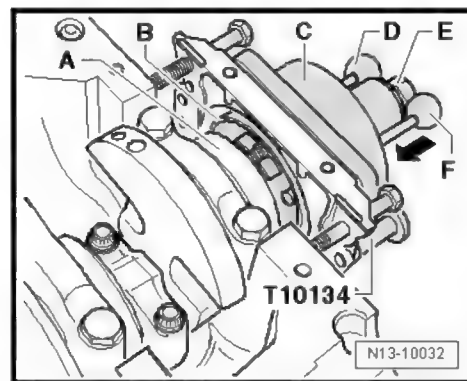
- Press the assembly housing -C- by hand in the direction of the -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange -A-.



Caution

Do not interchange components.

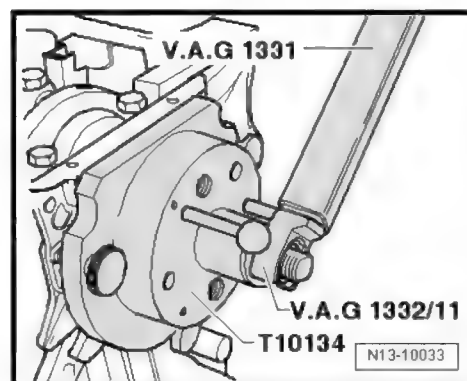
- ◆ *The guide pin for PETROL engines (red handle) -F- MUST NOT be inserted into the threaded hole in the crankshaft.*



- Push guide pin for diesel engine (black handle) -D- into hole in crankshaft. This brings the sender wheel into its final installation position.
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.

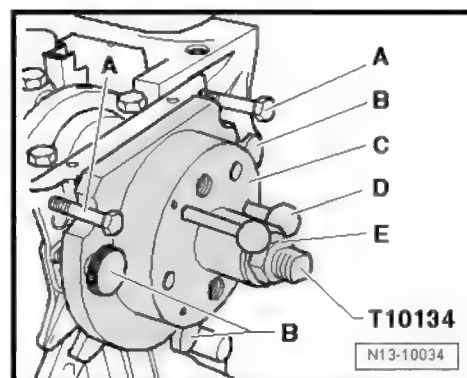
D - Pressing sender wheel onto crankshaft flange with assembly tool - T10134- :

- Tighten hexagon nut on assembly tool - T10134- to 35 Nm.
- A small air gap must be present between cylinder block and sealing flange after tightening hexagon nut to 35 Nm.

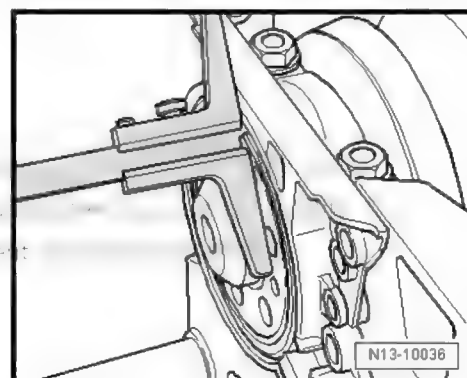


E - Checking installation position of sender wheel on crankshaft:

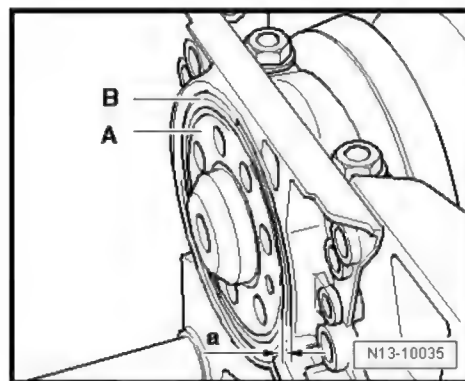
- Screw hexagon nut -E- to end of threaded spindle.
- Remove bolts -A- from cylinder block.
- Unscrew knurled screws -B- from sealing flange.
- Remove hexagon socket head bolts.
- Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts from crankshaft flange).
- Detach sealing lip support ring.



- Apply depth gauge -VAS 6082- to crankshaft flange.

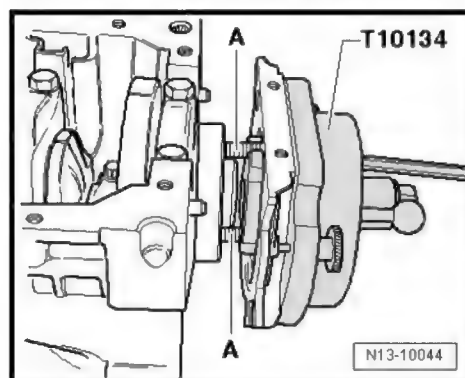


- Measure distance between crankshaft flange -A- and sender wheel -B-.
- Specification: Distance -a- = 0.5 mm.
- Press sender wheel in further if distance -a- is too small
⇒ [page 64](#) .
- If reading matches specification, continue with assembly
⇒ [page 65](#) .

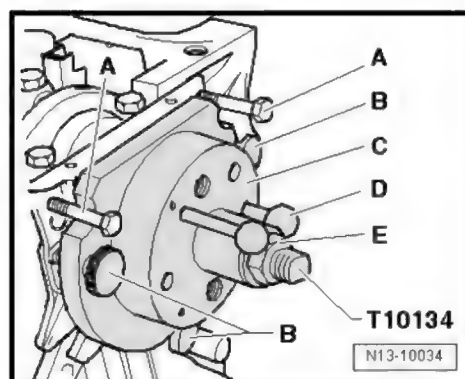


F - Pressing sender wheel in further:

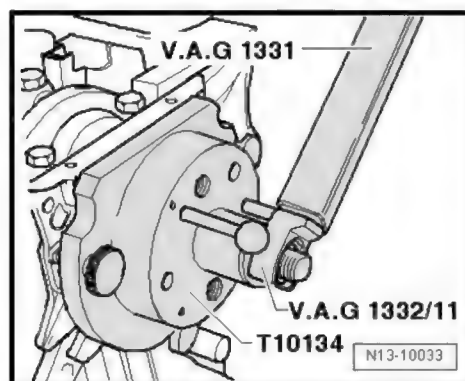
- Secure assembly tool - T10134- to crankshaft flange by tightening hexagon socket head bolts -A- hand-tight.
- Press assembly tool onto sealing flange by hand.



- Screw hexagon nut -E- onto threaded spindle by hand until it lies against the assembly housing -C-.



- Tighten hexagon nut on assembly tool - T10134- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 63](#) .
- If distance "a" is still too small, tighten hexagon nut on assembly tool - T10134- to 45 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 63](#) .



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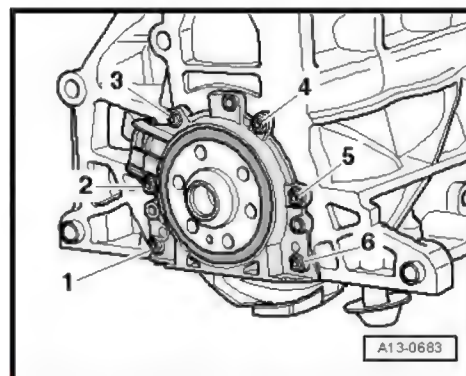


Assembling:

- Tighten sealing flange bolts ➔ [page 56](#) .

Installation is carried out in the reverse order; note the following:

- Install engine speed sender - G28- ➔ [page 308](#) .
- Install sump ➔ [page 139](#) .
- Install intermediate plate ➔ [page 56](#) .
- Install drive plate ➔ [page 56](#) .



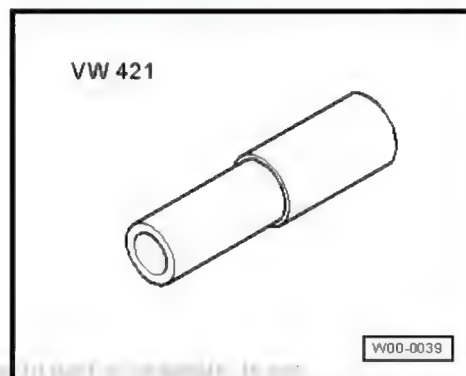
2.4 Renewing needle bearing in drive plate

Special tools and workshop equipment required

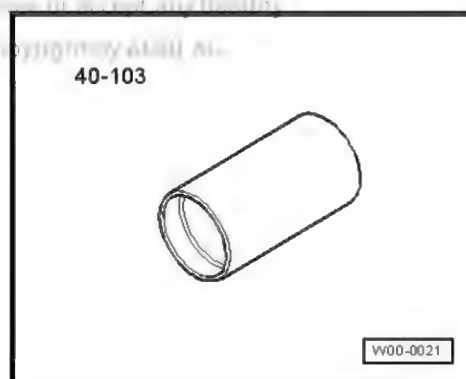
- ◆ Tube - VW 418 A-



- ◆ Tube - VW 421-



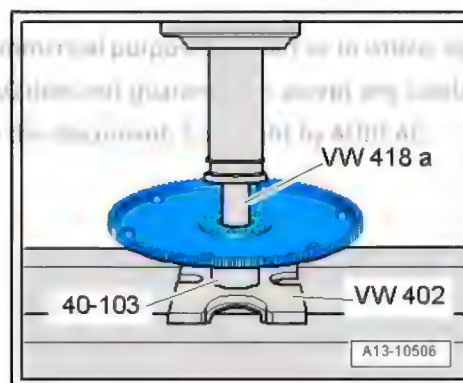
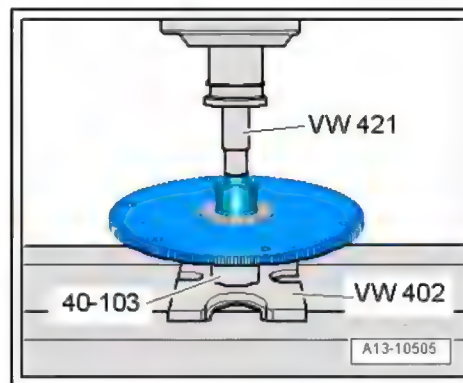
- ◆ Support - 40 - 103-





Procedure

- Gearbox removed ⇒ Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox or ⇒ Rep. gr. 37 ; Removing and installing gearbox; Removing gearbox .
- Remove drive plate ⇒ [page 56](#) .
- Place support - 40 - 103- under drive plate when pressing out and pressing in needle bearing.
- Use tube - VW 421- and workshop press and press out needle bearing.
- Smaller diameter of tube -VW 421- faces drive plate.
- Carefully press in needle bearing as far as stop, using tube - VW 418 A- and workshop press.
- Installation position: closed side of needle bearing faces engine.
- Install drive plate ⇒ [page 56](#) .





3 Crankshaft

⇒ "3.1 Exploded view - crankshaft", page 67

⇒ "3.2 Crankshaft dimensions", page 68

⇒ "3.3 Measuring axial clearance of crankshaft", page 68

⇒ "3.4 Measuring radial clearance of crankshaft", page 68

⇒ "3.5 Renewing spur gear", page 69

3.1 Exploded view - crankshaft



Note

When performing assembly work, secure engine to engine and gearbox support ⇒ [page 27](#).

1 - Bearing shell

- ☐ For cylinder block (with oil groove)
- ☐ Renew used bearing shells

2 - Spur gear

- ☐ For balance shaft assembly
- ☐ Pulling spur gear off crankshaft and shrink-fitting new spur gear ⇒ [page 69](#)

3 - Bearing shell

- ☐ For bearing cap (without oil groove)
- ☐ Renew used bearing shells

4 - Thrust washers

- ☐ For bearing No. 3
- ☐ Different types for cylinder block and bearing cap
- ☐ Note location

5 - Bolt

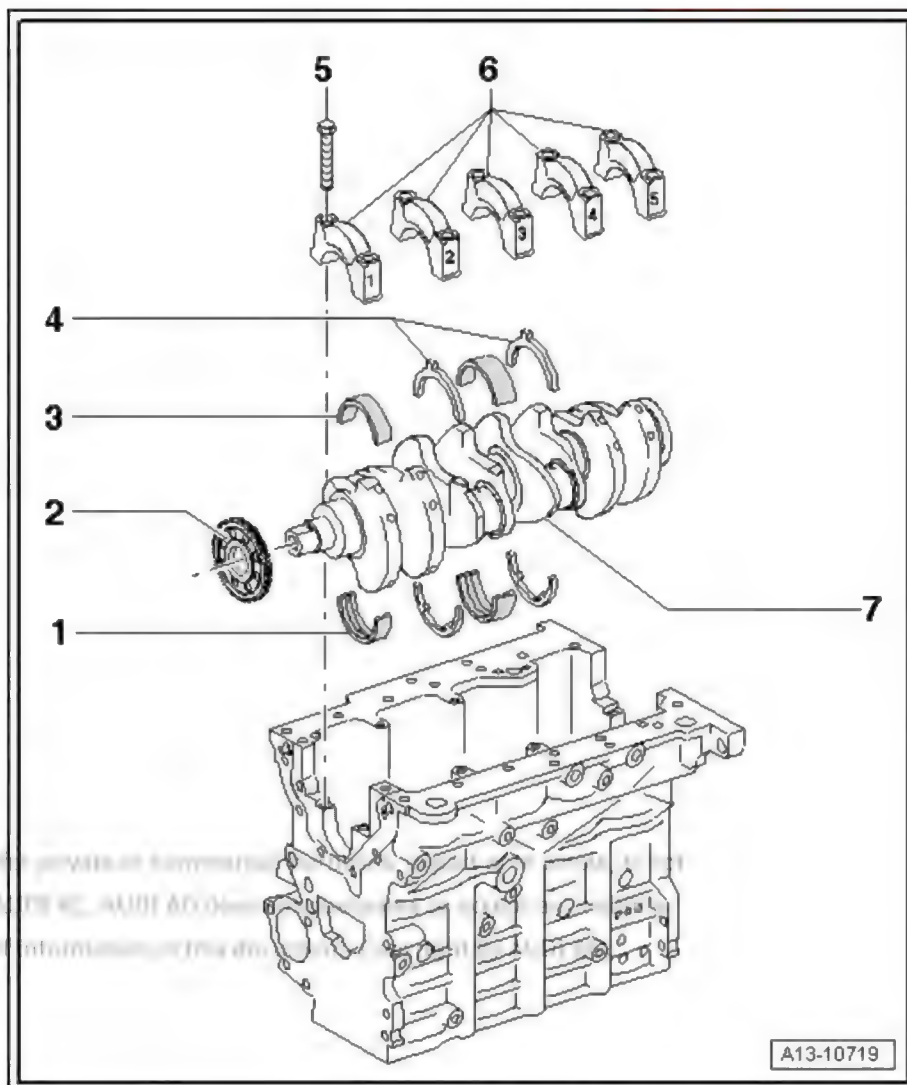
- ☐ Renew
- ☐ Use old bolts when measuring radial clearance
- ☐ 65 Nm +90°

6 - Bearing caps

- ☐ Bearing cap 1: Pulley end
- ☐ Bearing cap 3 with recesses for thrust washers
- ☐ Installation position: retaining lugs on bearing shells in cylinder block and bearing caps must be on the same side

7 - Crankshaft

- ☐ Crankshaft dimensions ⇒ [page 68](#)



A13-10719



- ❑ Measuring axial clearance ➔ [page 68](#)
- ❑ Measuring radial clearance ➔ [page 68](#)

3.2 Crankshaft dimensions

	Crankshaft main bearing journal Ø mm		Conrod journal Ø mm	
Basic dimension	54.00	-0.022 -0.042	50.90	-0.022 -0.042

3.3 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



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- ◆ Dial gauge - VAS 6079-

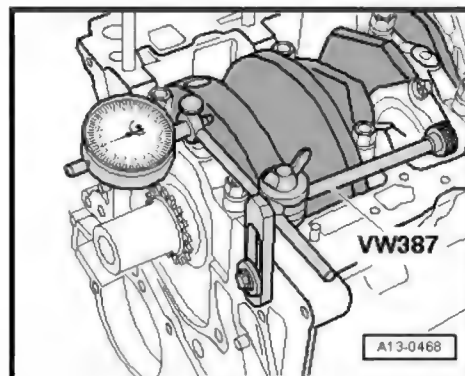


Procedure

- Bolt dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- onto cylinder block (as shown in illustration) and set it against crank web.
- Press crankshaft against dial gauge by hand.
- Set dial gauge to "0".
- Push crankshaft away from dial gauge and read off value.

Axial clearance:

- New: 0.07 ... 0.17 mm.
- Wear limit: 0.37 mm



3.4 Measuring radial clearance of crankshaft

Special tools and workshop equipment required



◆ Plastigauge

Procedure

- Remove bearing cap and clean bearing journal.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- The Plastigauge must be positioned in the centre of the bearing shell.
- Fit bearing cap and tighten with old bolts. Do not rotate crankshaft.
- Remove bearing cap again.
- Compare width of Plastigauge with measurement scale.

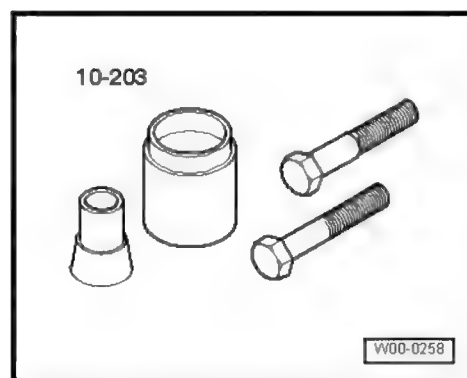
Radial clearance:

- New: 0.03 ... 0.08 mm.
- Wear limit: 0.17 mm.
- When carrying out final assembly, renew bolts.

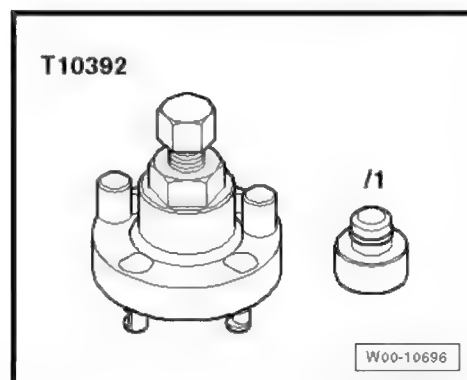
3.5 Renewing spur gear

Special tools and workshop equipment required

- ◆ Fitting tool - 10 - 203-



- ◆ Puller - T10392-

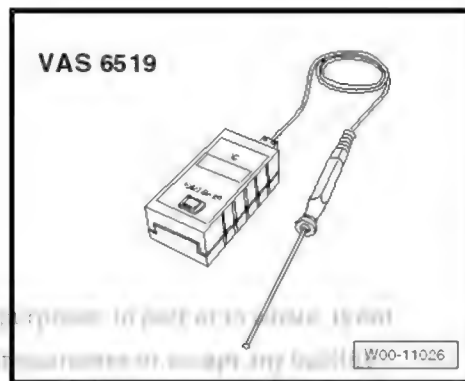




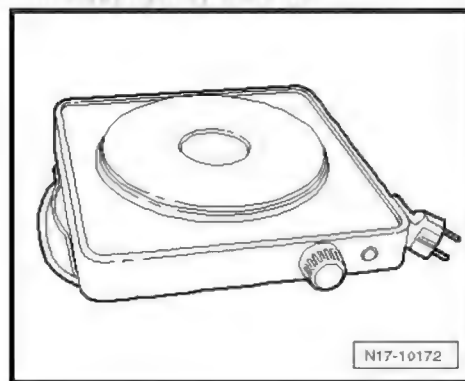
◆ Temperature gauge - VAS 6519-



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◆ Hotplate (commercially available)



◆ Protective gloves

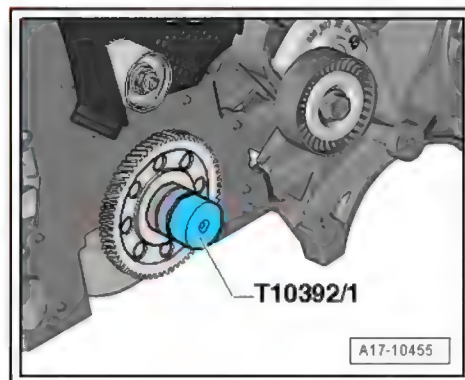
Procedure

- Remove sealing flange (pulley end) ⇒ [page 51](#) .
- Remove sump ⇒ [page 139](#) .

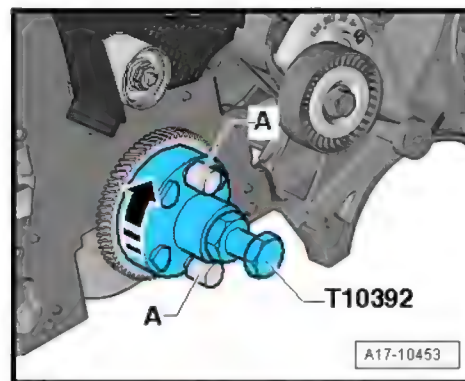


Note

- ◆ *If the balance shaft assembly does not have to be renewed, it is sufficient just to remove the idler gear.*
- ◆ *If the bolt for the idler gear for the balance shaft assembly has been slackened or the spur gear on the crankshaft or the crankshaft itself have been renewed, you must install a new idler gear with the appropriate coating. Procedure for installation*
⇒ *"4.1.2 Installing new balance shaft assembly", page 151 .*
- Remove idler gear ⇒ [Item 13 \(page 136\)](#) for balance shaft assembly or remove balance shaft assembly ⇒ [page 150](#) .
- Insert thrust piece -T10392/1- in end of crankshaft.



- Insert puller -T10392- into holes in spur gear, turn clockwise -arrow- and screw in locating pins -A-.

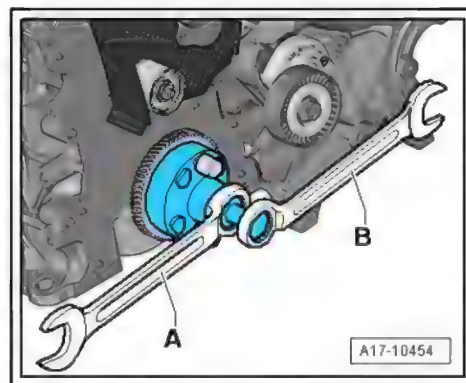


- Counterhold crankshaft with ring spanner -A- and pull spur gear off end of crankshaft by screwing in spindle with ring spanner -B-.



Note

- ◆ While heating up the new spur gear, monitor the temperature with the temperature gauge -VAS 6519-.
- ◆ When the temperature reaches 200 °C, you have approx. 4 seconds to fit the spur gear on the crankshaft.
- ◆ A higher temperature increases the amount of time available (220 °C = approx. 6 seconds).
- ◆ Make sure the end of the crankshaft is clean.



Caution

Do not exceed a maximum temperature of 240 °C; otherwise the spur gear can become discoloured and distorted.

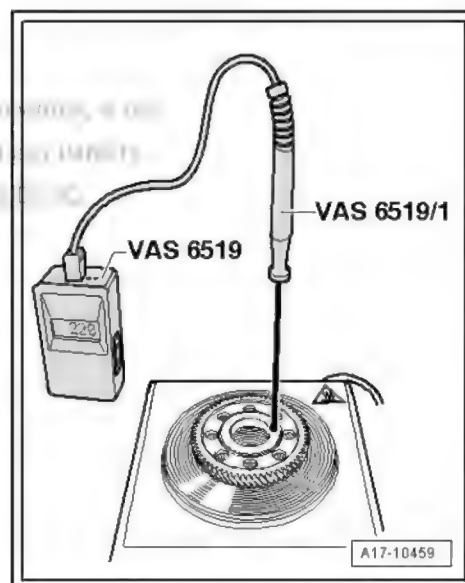
- Place the new spur gear flat on a commercially available hot-plate and heat it up to at least 200 °C, but not more than 240 °C. Lettering faces upwards.
- Set temperature gauge -VAS 6519- to measuring range 2.
- Position temperature sensor -VAS 6519/1- on collar of spur gear (as shown) and read off temperature at temperature gauge.



WARNING

Risk of burns.

- ◆ Use protective gloves for the following steps.



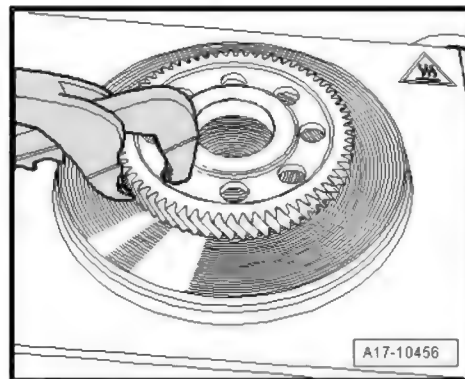


- When the required temperature has been reached, pick up the spur gear with pliers as illustrated.



Note

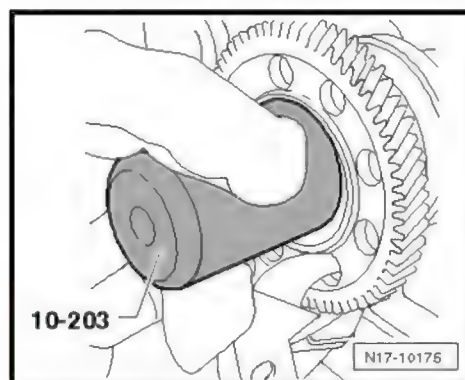
Take care not to damage the teeth of the spur gear.



- With the aid of fitting tool - 10 - 203- , slide spur gear by hand onto end of crankshaft as far as stop. This must be done without delay, taking care to keep the gear straight.
- Wait a few minutes to allow the spur gear to cool down.
- Install balance shaft assembly
⇒ ["4.1.2 Installing new balance shaft assembly", page 151](#) .

Or

- Install idler gear for balance shaft assembly
⇒ ["4.1.2 Installing new balance shaft assembly", page 151](#) .
- Install sealing flange (pulley end) ⇒ [page 51](#) .



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4 Pistons and conrods

⇒ "4.1 Exploded view - pistons and conrods", page 73

⇒ "4.2 Removing and installing pistons", page 75

⇒ "4.3 Measuring piston projection at TDC", page 77

⇒ "4.4 Checking pistons and cylinder bores", page 79

⇒ "4.5 Checking radial clearance of conrod bearings",
page 80

4.1 Exploded view - pistons and conrods



Note

- ◆ All bearing and running surfaces must be oiled before assembling.
- ◆ Oil spray jet and pressure relief valve ⇒ [page 75](#)

1 - Bolt

- ☐ Renew
- ☐ Use old bolts when measuring radial clearance
- ☐ Lubricate threads and contact surface
- ☐ 30 Nm +90°

2 - Conrod bearing cap

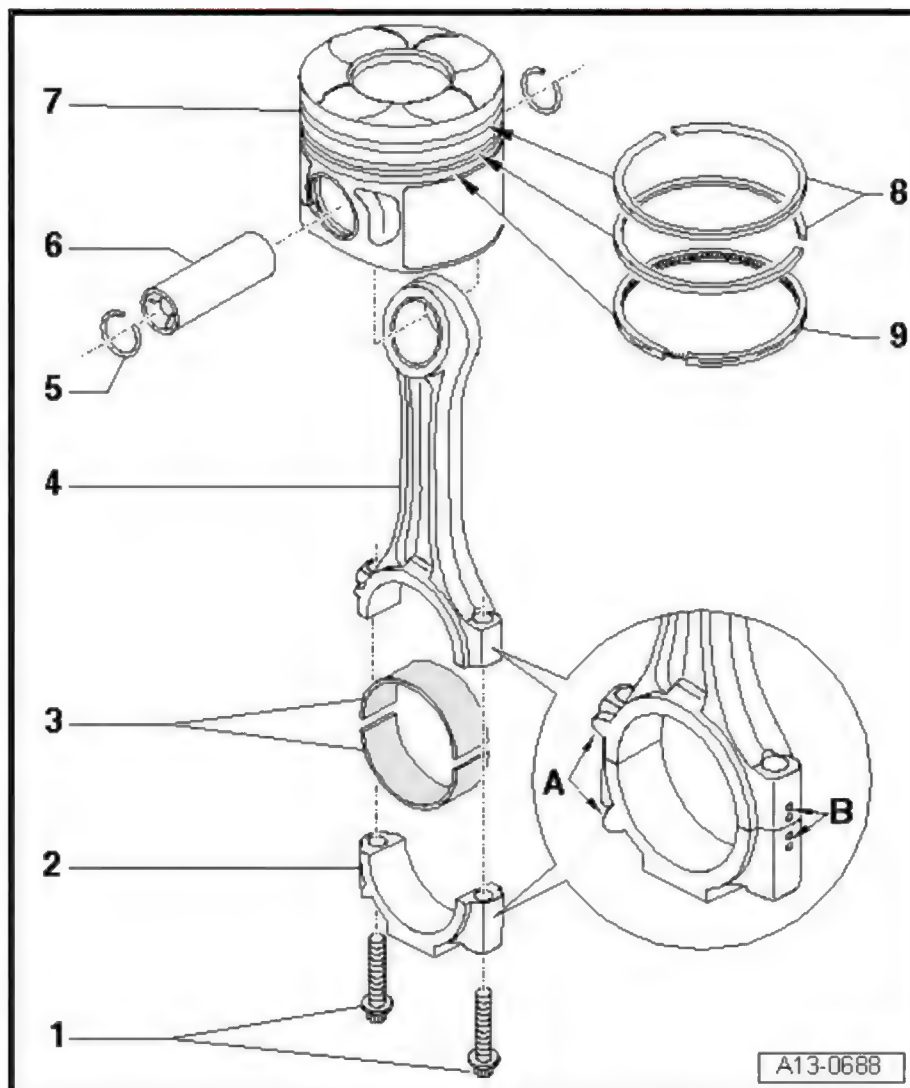
- ☐ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ☐ Mark cylinder allocation in colour -B-
- ☐ Installation position: Markings -A- face towards pulley end

3 - Bearing shell

- ☐ Installation position ⇒ [page 75](#)
- ☐ Renew used bearing shells
- ☐ Note version: Upper bearing shell (closest to piston) is constructed from a more wear-resistant material; refer to ⇒ Electronic parts catalogue
- ☐ Check that it is securely seated

4 - Conrod

- ☐ Only renew as a complete set

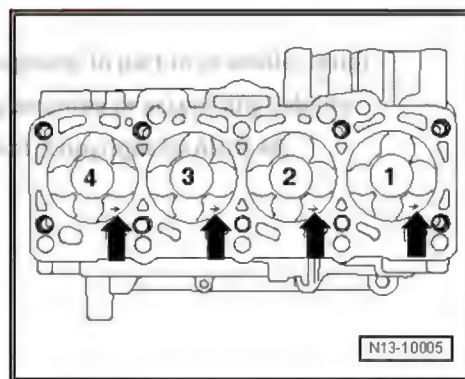




- ☐ With industrially cracked conrod bearing cap
 - ☐ Separating parts of new conrod ⇒ [page 75](#)
 - ☐ Mark cylinder allocation in colour -B-
 - ☐ Installation position: Markings -A- face towards pulley end
 - ☐ Axial clearance: wear limit: 0.37 mm
 - ☐ Measuring radial clearance ⇒ [page 80](#)
- 5 - Circlip
- ☐ Renew
- 6 - Piston pin
- ☐ If difficult to move, heat piston to approx. 60 °C
 - ☐ Remove and install using drift - VW 222 A-
- 7 - Piston
- ☐ With combustion chamber
 - ☐ Version fitted in vehicle may differ from illustration
 - ☐ Mark installation position and cylinder number ⇒ [page 74](#)
 - ☐ Checking ⇒ [page 79](#)
 - ☐ Install using piston ring clamp
 - ☐ Piston and cylinder dimensions ⇒ [page 79](#)
 - ☐ Measuring cylinder bore ⇒ [page 79](#)
 - ☐ Measuring piston projection at "TDC" ⇒ [page 77](#)
- 8 - Piston rings
- ☐ Compression rings
 - ☐ Offset gaps by 120°
 - ☐ Use piston ring pliers to remove and install
 - ☐ Installation position: marking "TOP" or side with lettering faces towards piston crown
 - ☐ Measuring ring gap ⇒ [page 79](#)
 - ☐ Measuring ring-to-groove clearance ⇒ [page 80](#)
- 9 - Piston ring
- ☐ Oil scraper ring
 - ☐ Offset gap 120° from bottom compression ring
 - ☐ Use piston ring pliers to remove and install
 - ☐ Measuring ring gap ⇒ [page 79](#)
 - ☐ Measuring ring-to-groove clearance ⇒ [page 80](#)

Installation position of pistons and allocation of piston/cylinder

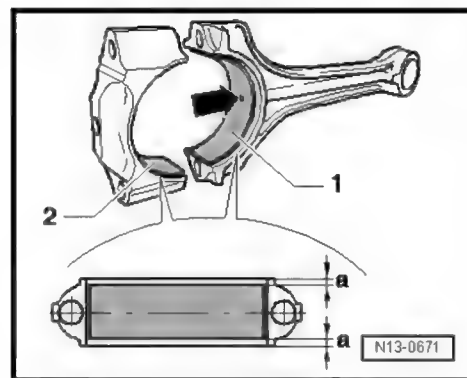
- Arrow on piston crown points to pulley end -arrows-:





Installation position of bearing shells in conrods

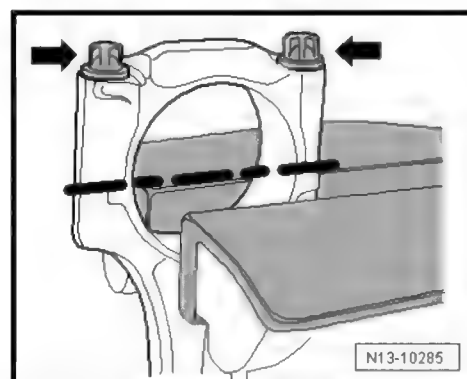
- 1 - Bearing shell with oil drilling -arrow- for conrod.
 - 2 - Bearing shell without oil drilling for conrod bearing cap.
- Insert bearing shells centrally in conrod/conrod bearing cap.
 - Distance -a- is the same on both sides.



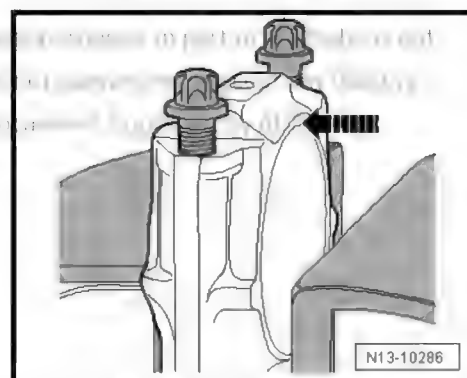
Separating parts of new conrod

It is possible that the two parts of a new conrod are not completely separated as intended. If it is not possible to take off the conrod bearing cap by hand, proceed as follows:

- To avoid any risk of damage, the conrod should only be clamped lightly in a vice using jaw covers as shown in illustration.
- The conrod is clamped in position below the dotted line.
- Unscrew bolts -arrows- approx. 5 turns.



- Using a plastic hammer, carefully knock conrod bearing cap loose -arrow-.



Oil spray jet and pressure relief valve

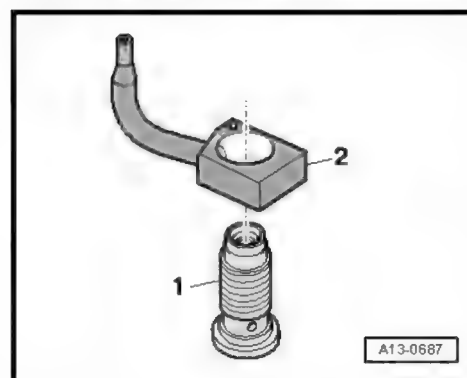
- 1 - Bolt with pressure relief valve, 27 Nm
 - 2 - Oil spray jet (for cooling of pistons)
- Installation position: align locating edge of oil spray jet with machined surface of cylinder block.



Caution

Risk of damage to oil spray jets.

- ◆ *Do not bend oil spray jets.*
- ◆ *Always renew bent oil spray jets.*



4.2 Removing and installing pistons

Special tools and workshop equipment required



◆ Pin - VW 222 A-



◆ Piston ring clamp, commercially available

Removing

- Engine secured to engine and gearbox support ⇒ [page 27](#) .
- Remove cylinder head ⇒ [page 98](#) .
- Remove balance shaft assembly ⇒ [page 150](#) .
- Mark installation position and matching of conrod bearing caps to conrods for re-installation ⇒ [Item 2 \(page 73\)](#) .
- Unbolt conrod bearing caps.
- Pull out pistons upwards with conrods.



Note

If piston pin is difficult to remove, heat piston to approx. 60 °C.

- Take circlip out of piston pin boss.
- Use drift - VW 222 A- to drive out piston pin.

Installing

Installation is carried out in reverse order; note the following:



Note

Renew the bolts tightened with specified tightening angle.

- Oil running surfaces of bearing shells.
- Install pistons using piston ring clamp.

Installation position:

- Pistons ⇒ [page 74](#)
- Bearing shells in conrods ⇒ [page 75](#)
- Install conrod bearing caps according to markings.
- Install balance shaft assembly ⇒ [page 150](#) .
- Install cylinder head ⇒ [page 98](#) .

Tightening torques

- ◆ ⇒ [“4.1 Exploded view - pistons and conrods”, page 73](#)



4.3 Measuring piston projection at TDC

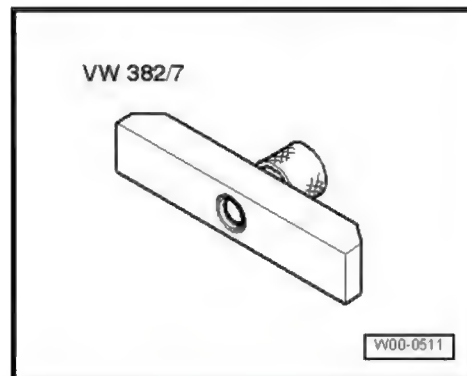


Note

Piston projection at "TDC" must be measured when installing new pistons or a short engine.

Special tools and workshop equipment required

- ◆ Measuring bridge -VW 382/7- from measuring tool - VW 382-



- ◆ Measuring plate -VW 385/17- from universal measuring tool - VW 385-



- ◆ Dial gauge - VAS 6079-



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Procedure

- Secure dial gauge - VAS 6079- with measuring bridge - VW 382/7- and measuring plate -VW 385/17- to cylinder block as shown in illustration.
- Measure piston projection at two points marked with -arrows- for each piston.

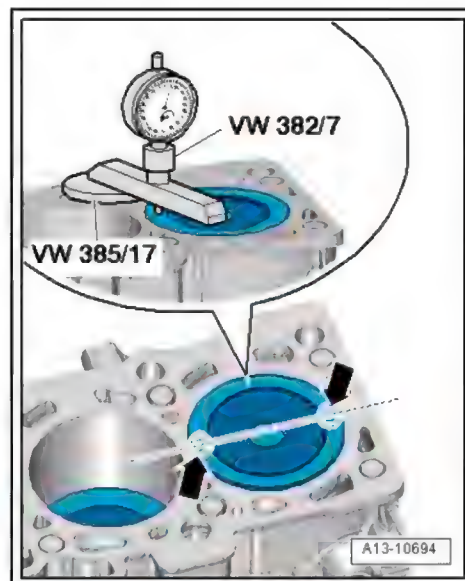


Note

If the measured values for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.

- Depending on piston projection, install corresponding cylinder head gasket according to following table:

Piston projection above top surface of cylinder block mm	Identification (no. of holes)
0.91 ... 1.00	1
1.01 ... 1.10	2
1.11 ... 1.20	3



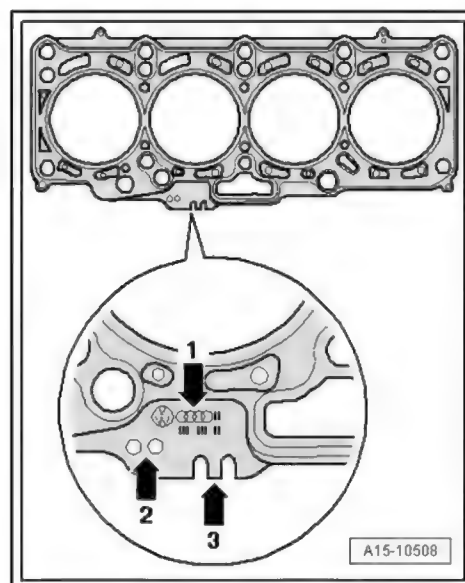
Identification of cylinder head gasket

- 1 - Part number
- 2 - Holes
- 3 - Ignore



Note

If the measured values for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.



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4.4 Checking pistons and cylinder bores

Checking piston

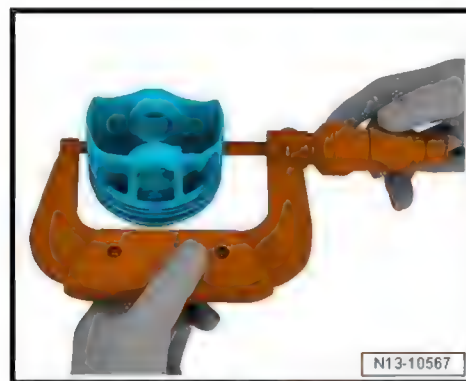
- Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.
- Maximum deviation from nominal dimension: 0.04 mm.



Note

Renew piston if cracking is visible on piston skirt.

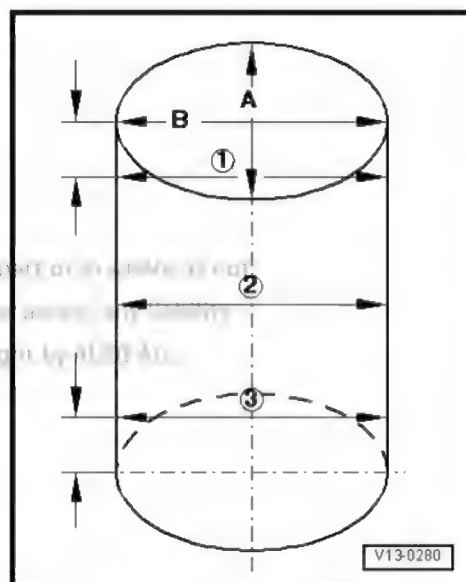
Piston Ø	
Nominal dimension	80.96 mm ¹⁾
<ul style="list-style-type: none"> • ¹⁾ Dimensions including coating (thickness 0.02 mm). The coating will wear down in service. 	



Measuring cylinder bore

- Use a cylinder gauge - VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.
- Maximum deviation from nominal dimension: 0.10 mm.

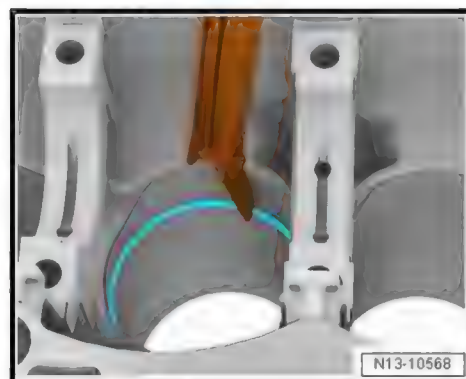
Cylinder bore Ø	
Nominal dimension	81.01 mm



Measuring piston ring gap

- Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder.
- To do so, use a piston without rings.

Piston ring	new mm	Wear limit mm
1st compression ring	0.25 ... 0.40	1.00
2nd compression ring	0.25 ... 0.40	1.00
Oil scraper ring	0.25 ... 0.50	1.00





Measuring ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1st compression ring	0.06 ... 0.09	0.25
2nd compression ring	0.05 ... 0.08	0.25
Oil scraper ring	0.03 ... 0.06	0.15



4.5 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

- ◆ Plastigauge

Procedure

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- Fit conrod bearing cap and secure with old bolts
⇒ [Item 1 \(page 73\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigauge with measurement scale.

Radial clearance:

- Wear limit: 0.08 mm.
- Renew conrod bolts.



15 – Cylinder head, valve gear

1 Toothed belt drive

⇒ [“1.1 Exploded view - toothed belt”, page 81](#)

⇒ [“1.2 Removing and installing toothed belt”, page 83](#)

1.1 Exploded view - toothed belt

1 - Toothed belt

- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Check for wear
- ☐ Removing ⇒ [page 83](#)
- ☐ Installing (adjusting valve timing)
⇒ [page 87](#)

2 - Idler roller

3 - Nut

- ☐ Make sure that stud is fitted securely
- ☐ 20 Nm

4 - Stud

- ☐ 15 Nm

5 - Nut

- ☐ Renew nut
- ☐ Make sure that stud is fitted securely
- ☐ 20 Nm +45°

6 - Tensioning roller

7 - Stud

- ☐ 15 Nm

8 - Bolt

- ☐ 20 Nm

9 - Idler roller

10 - Bolt

- ☐ Renew
- ☐ 20 Nm +45°

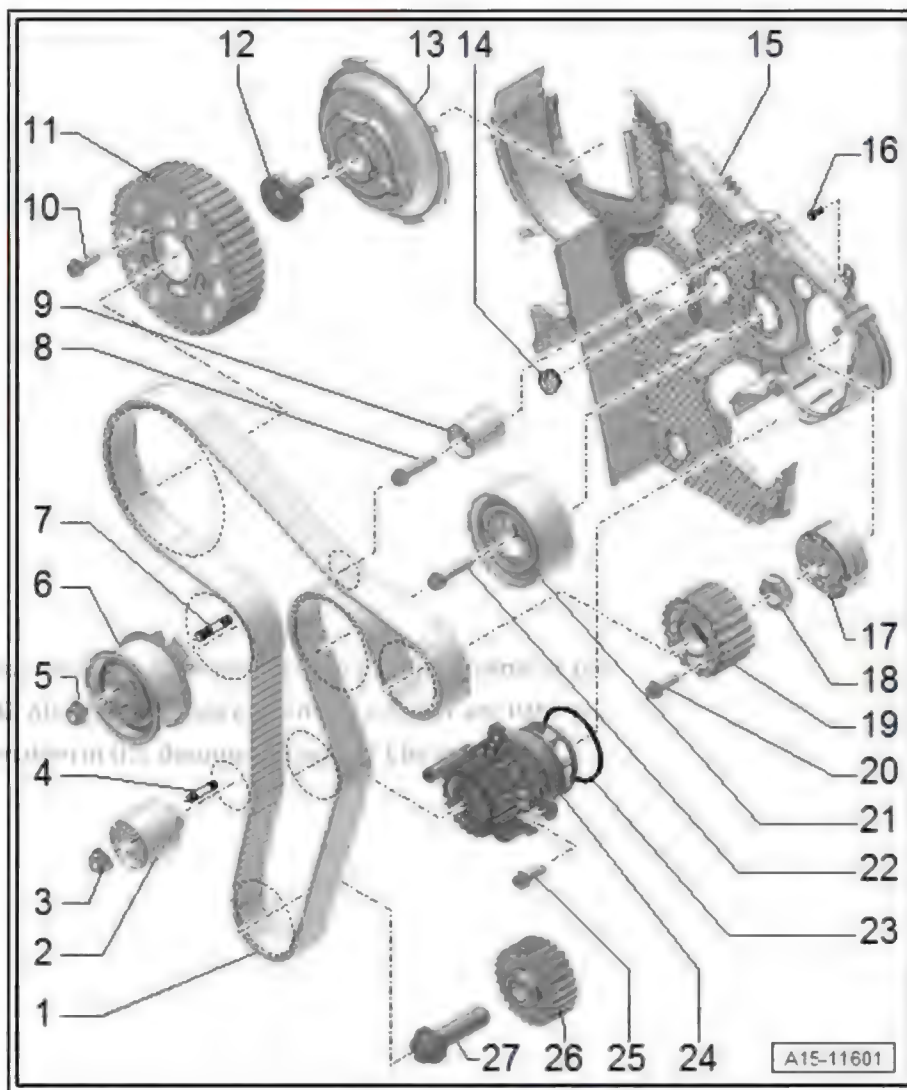
11 - Camshaft sprocket

12 - Bolt

- ☐ Slacken and tighten with counterhold tool - T10051-
- ☐ 100 Nm

13 - Hub

- ☐ For camshaft
- ☐ Removing and installing ⇒ [“3.5 Removing and installing camshaft”, page 118](#)





14 - Plug

15 - Toothed belt cover (rear)

16 - Bolt

- ☐ 9 Nm

17 - Hub

- ☐ For high-pressure pump
- ☐ Removing and installing ⇒ [page 262](#)

18 - Nut

- ☐ Tightening torque ⇒ [Item 6 \(page 262\)](#)

19 - High-pressure pump sprocket

20 - Bolt

- ☐ Tightening torque ⇒ [Item 5 \(page 262\)](#)

21 - Idler roller

22 - Bolt

- ☐ Renew
- ☐ 50 Nm +90°

23 - O-ring

- ☐ Renew

24 - Coolant pump

- ☐ Removing and installing ⇒ [page 173](#)

25 - Bolt

- ☐ Tightening torque ⇒ [Item 2 \(page 169\)](#)

26 - Crankshaft sprocket

- ☐ Contact surface between sprocket and crankshaft must be free of oil
- ☐ Can only be installed in one position

27 - Bolt

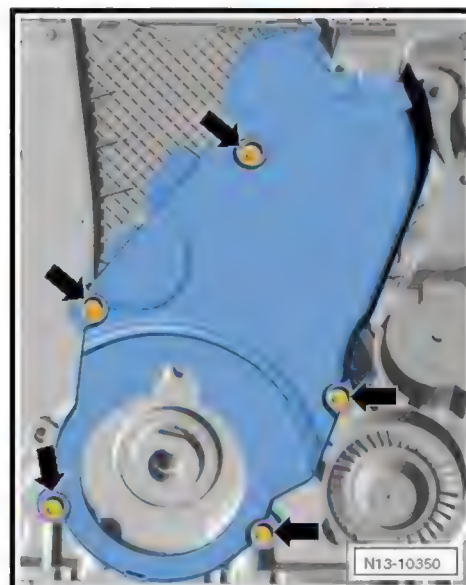
- ☐ Renew
- ☐ Slacken and tighten with counterhold tool - 3415-
- ☐ Do not additionally oil threads and shoulder

Tighten in three stages as follows:

- ◆ 1st stage: 180 Nm
- ◆ 2nd stage: Use rigid wrench to turn 90° further
- ◆ 3rd stage: Use rigid wrench to turn 45° further

Toothed belt cover (bottom) - tightening torque

- Tighten bolts -arrows- to 9 Nm.

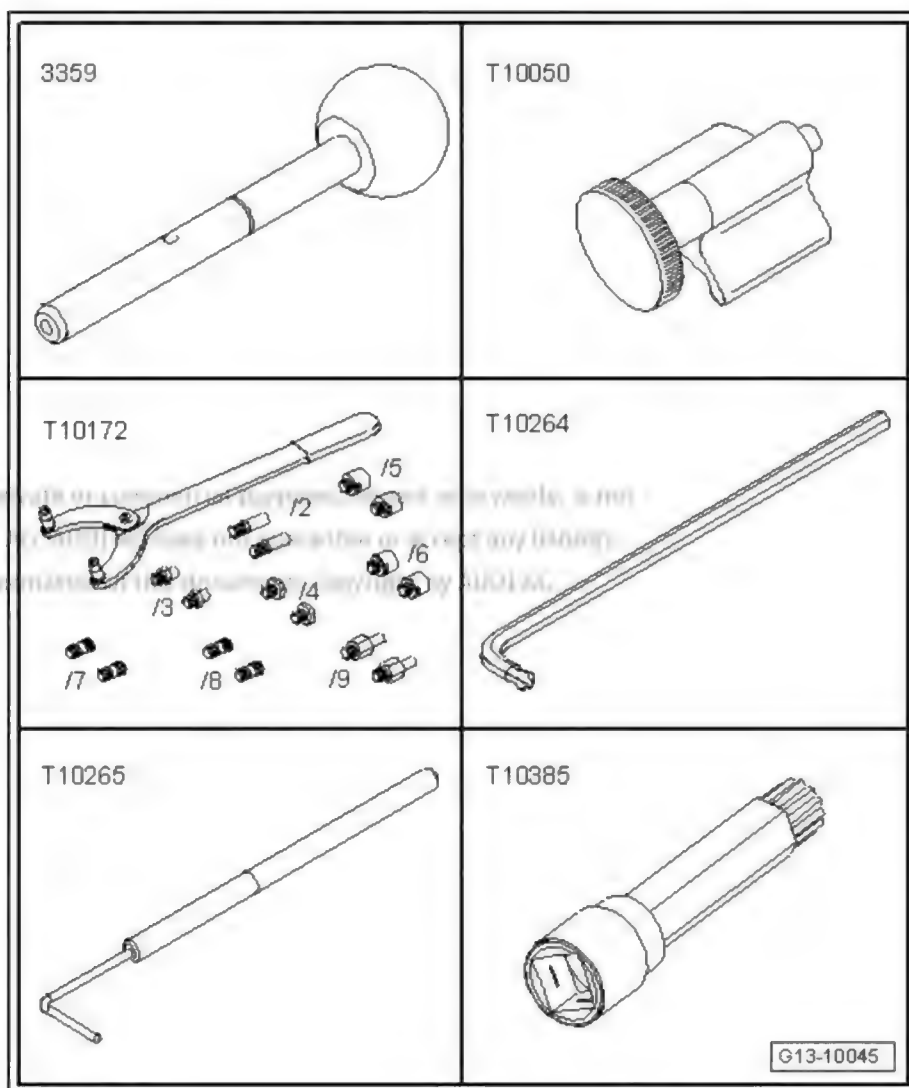


1.2 Removing and installing toothed belt

Special tools and workshop equipment required



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- ◆ 2x diesel injection pump locking pin - 3359-



- ◆ Crankshaft stop - T10050-
- ◆ Counterhold tool - T10172-
- ◆ Offset screwdriver - T10264-
- ◆ Locking tool - T10265-
- ◆ Bit XZN 10 - T10385- or bit M10

Removing



Caution

Running a used poly V-belt in the opposite direction could cause irreparable damage.

- ◆ *Before removing the poly V-belt, mark the direction of rotation with chalk or a felt-tip pen for re-installation.*

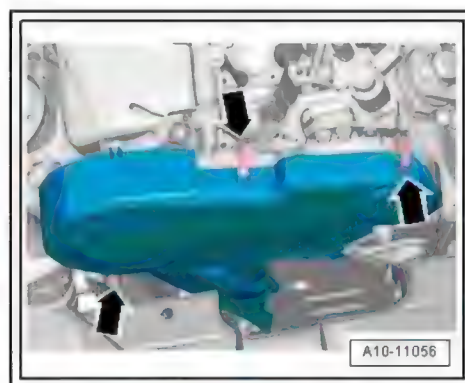
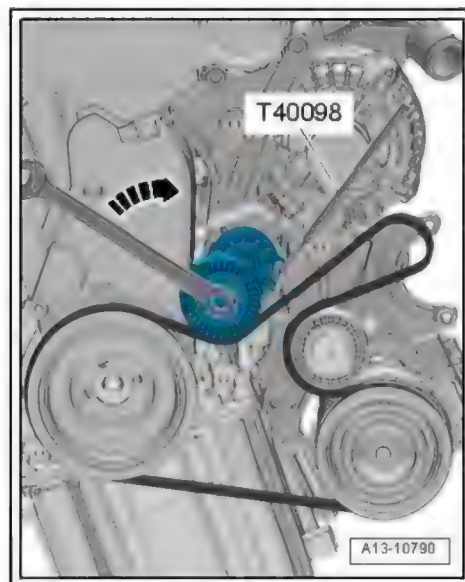
- Swivel tensioner in clockwise direction -arrow-, detach poly V-belt from alternator pulley and release tensioner.
- Take off poly V-belt.



Note

Ignore -T40098- .

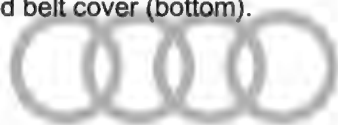
- Remove vibration damper ⇒ [page 47](#) .
- Release retaining clips -arrows- and detach toothed belt cover (top).



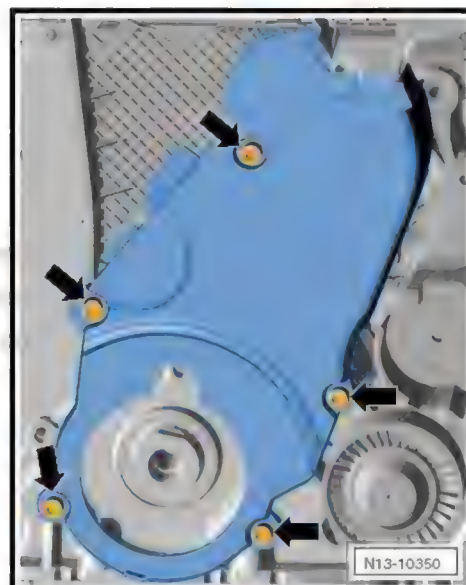
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- Remove bolts -arrows-.
- Detach toothed belt cover (bottom).



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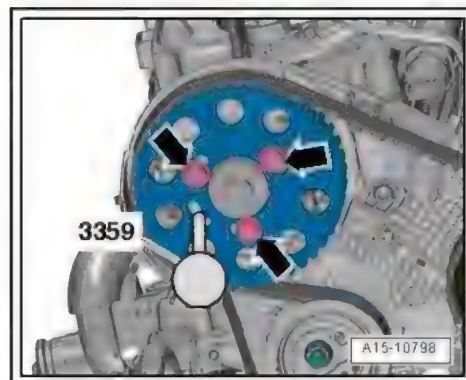


Caution

Irreparable damage can be caused if the toothed belt slips.

- ♦ Only turn crankshaft in direction of engine rotation.

- Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at "TDC".
- Lock camshaft hub with diesel injection pump locking pin - 3359- .



Note

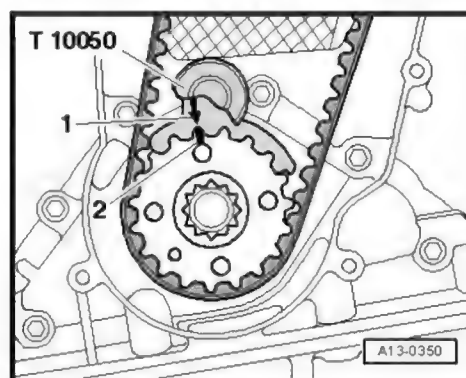
Disregard -arrows-.

- Lock crankshaft sprocket in position with crankshaft stop - T10050- .
- The markings on the sprocket -2- and the crankshaft stop -1- must align -arrow-. The pin of the crankshaft stop must engage in the aperture in the sealing flange.



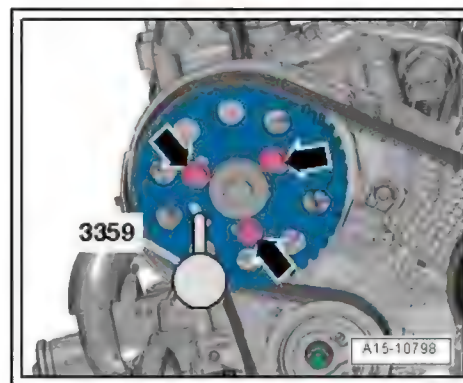
Note

The crankshaft stop can only be pushed onto the sprocket from the front face of the teeth.

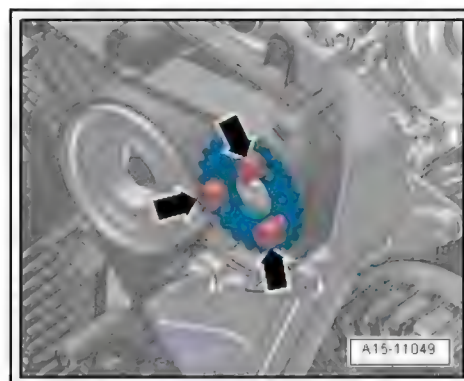




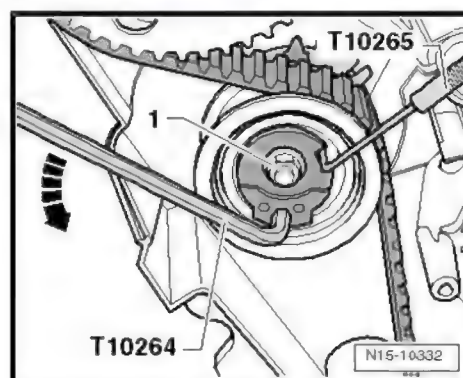
- Slacken bolts -arrows- for camshaft sprocket approx. 90°.



- Using an M10 bit, loosen bolts -arrows- for toothed belt sprocket on high-pressure pump by approx. 90°.



- Slacken nut -1- for tensioning roller.
- Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until tensioning roller can be secured with locking tool - T10265- .



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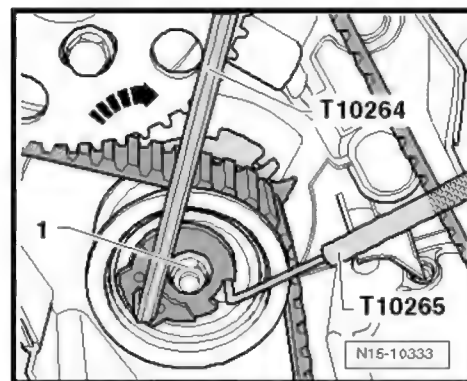
- Then use offset screwdriver - T10264- to turn eccentric adjuster of tensioning roller clockwise -arrow- as far as stop and tighten nut -1- by hand.



Caution

If a used belt runs in the opposite direction when it is refitted, this can cause breakage.

- ◆ *Before removing, mark direction of rotation of toothed belt with chalk or felt-tip pen for re-installation.*



- Take off toothed belt first from idler roller and then from remaining sprockets.

Installing (adjusting valve timing)



Note

Perform adjustments on toothed belt only when engine is cold.



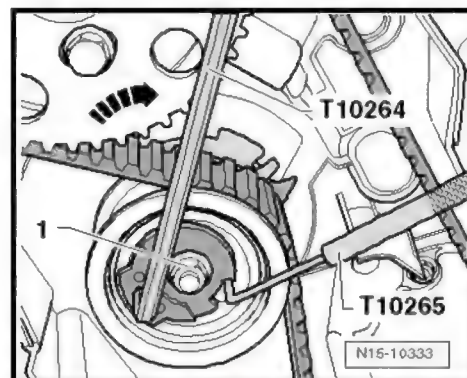
Caution

Risk of damage to valves and piston crowns.

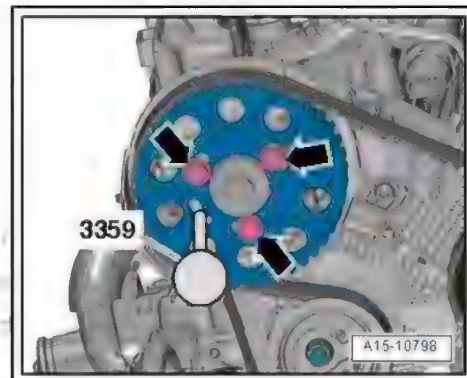
- ◆ *The crankshaft must not be at "TDC" at any cylinder when the camshaft is turned.*

Requirements:

- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.

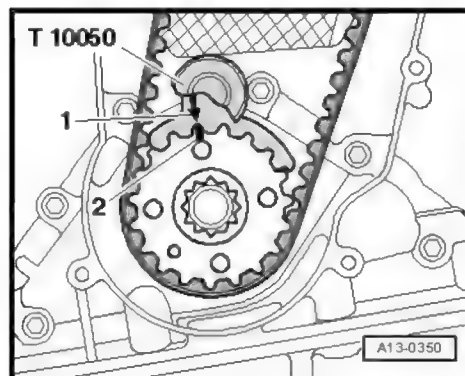


- Camshaft hub locked with diesel injection pump locking pin - 3359- .
- Renew bolts for camshaft sprocket one after the other.
- Loosely screw in new bolts -arrows-.
- It should just be possible to turn the sprocket on the camshaft without axial movement.

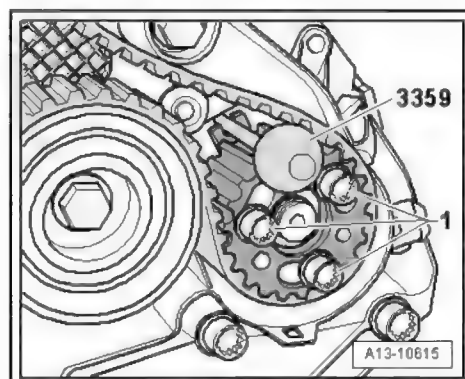




- Crankshaft is locked in position with crankshaft stop - T10050- .

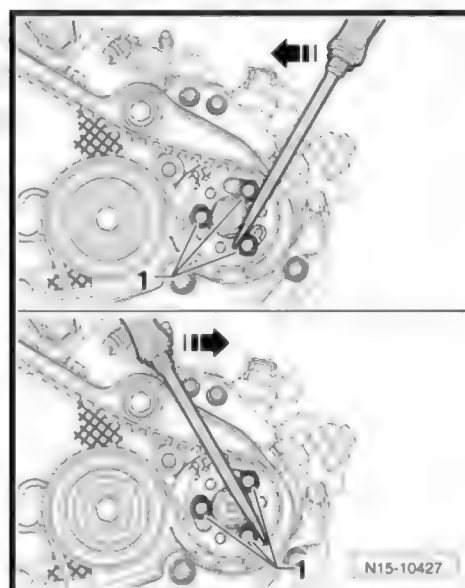


- Hub of high-pressure pump locked with diesel injection pump locking pin - 3359- .
- Bolts -1- are fitted but not tightened.
- The high-pressure pump sprocket should still just turn, but there must be no axial movement.



Note

If necessary, apply a screwdriver -arrows- to bolt heads 1- and turn the high-pressure pump hub until it can be locked with the locking pin.

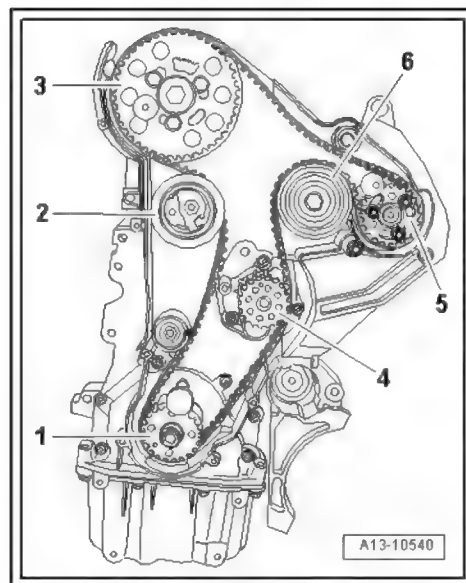




- Turn the camshaft sprocket and high-pressure pump sprocket in their elongated holes clockwise as far as the stop.

- Install toothed belt in the specified sequence:

- 1 - Crankshaft sprocket
- 2 - Tensioning roller
- 3 - Camshaft sprocket
- 4 - Coolant pump sprocket
- 5 - High-pressure pump sprocket
- 6 - Idler roller

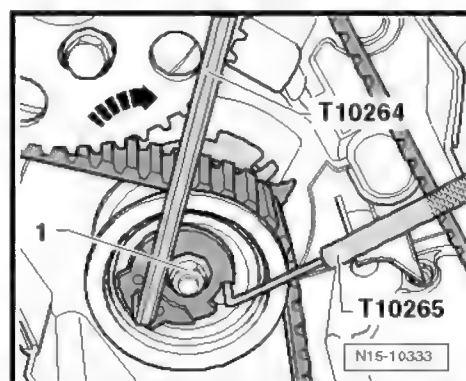


- Loosen nut -1- for tensioning roller and detach locking tool - T10265-.



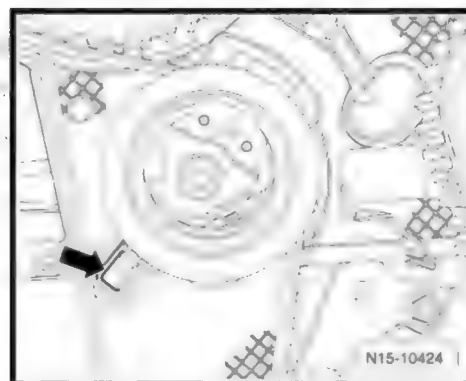
Note

Disregard -arrow-.

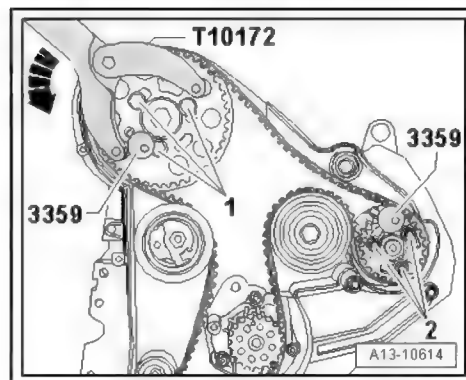


Note

Ensure that tensioning roller is seated properly in toothed belt cover (rear) -arrow-.



- Position counterhold tool - T10172- on camshaft sprocket as shown in illustration.
- Apply force to counterhold tool in anti-clockwise direction -arrow- and maintain tension.
- Tighten bolts -1- for camshaft sprocket and bolts -2- for high-pressure pump sprocket in this position.
- Initial tightening torque: 20 Nm



- Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -2- aligns with centre of slot on base plate.
- Nut -1- must not turn.
- Hold tensioning roller in this position and tighten nut.
- Remove locking pins -3359- and crankshaft stop - T10050- .

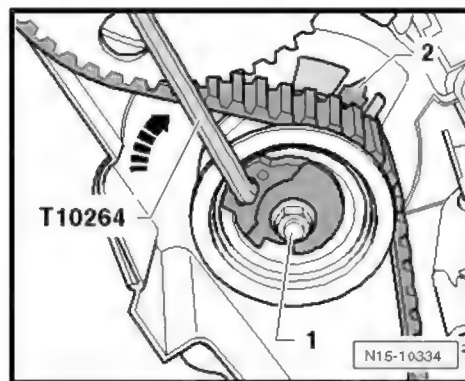
Checking valve timing:



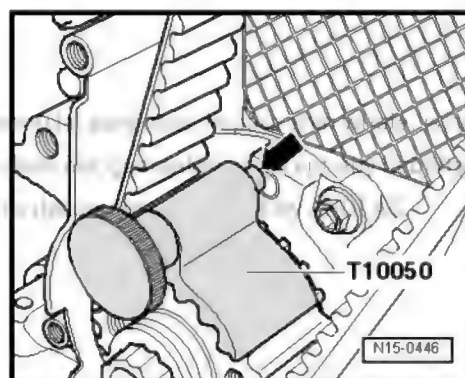
Caution

Irreparable damage can be caused if the toothed belt slips.

- ♦ *Only turn crankshaft in direction of engine rotation.*



- Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before "TDC".
- Fit crankshaft stop - T10050- to crankshaft sprocket again.
- Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.

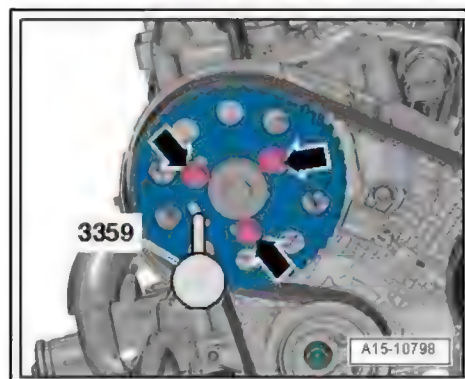


- It should now be possible to lock camshaft hub with diesel injection pump locking pin - 3359- .

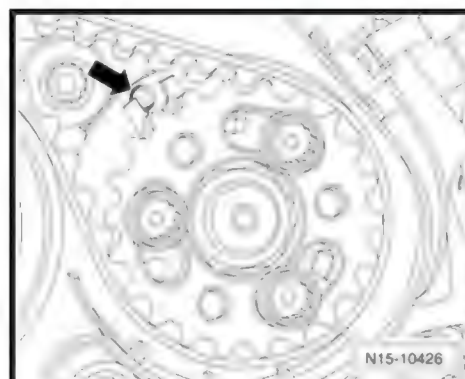


Note

Disregard -arrows-.



- It is very difficult to reproduce the locking position of the high-pressure pump hub. However, a slight deviation -arrow- does not influence engine operation.



- Pointer -2- on tensioner roller must be centred between tabs -1- and -3- on base plate.



Note

The maximum permissible sideways deviation from the specified position is 5 mm.

- ◆ Re-adjust valve timing if requirements are not met
⇒ [page 91](#) .
- ◆ If requirements are met, continue with procedure after adjusting valve timing correctly as described below ⇒ [page 91](#) .

Re-adjusting valve timing:

- If camshaft hub cannot be locked, withdraw crankshaft stop - T10050- until pin is clear of bore.
- Turn crankshaft in opposite direction of engine rotation slightly past "TDC".
- Now turn crankshaft slowly in direction of engine rotation until it is possible to lock camshaft hub.
- Loosen bolts for camshaft sprocket after locking hub.

A - If pin of crankshaft stop - T10050- is on left side of bore:

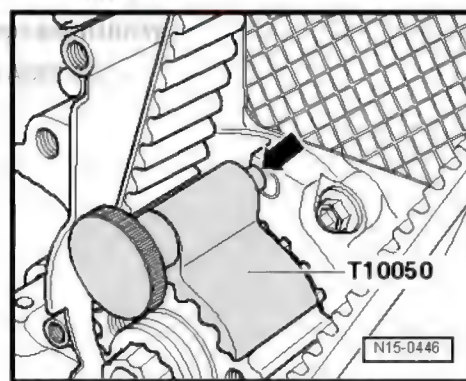
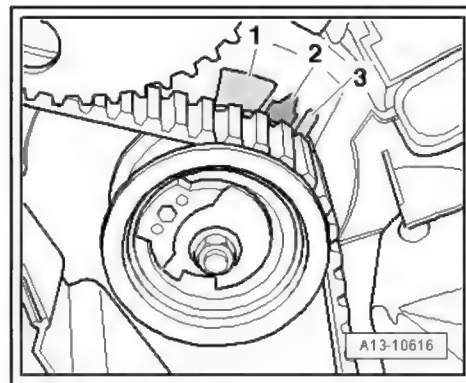
- Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.
- Tighten camshaft sprocket bolts to 20 Nm initially.

B - If pin of crankshaft stop - T10050- is on right side of bore:

- Turn crankshaft slightly in opposite direction to engine rotation.
- Turn crankshaft in direction of engine rotation again until pin of crankshaft stop engages in sealing flange as crankshaft rotates.
- Tighten camshaft sprocket bolts to 20 Nm initially.

Procedure after adjusting valve timing correctly:

- Remove diesel injection pump locking pin - 3359- and crankshaft stop - T10050- .
- Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before "TDC".
- Check valve timing once again ⇒ [page 90](#) .





- If camshaft hub can now be locked, tighten camshaft sprocket bolts -1- to final torque ⇒ [Item 10 \(page 81\)](#) .
- Tighten bolts -2- for high-pressure pump sprocket to final torque ⇒ [Item 5 \(page 262\)](#) .
- Check valve timing once again ⇒ [page 90](#) .

Assembling

Installation is carried out in the reverse order; note the following:

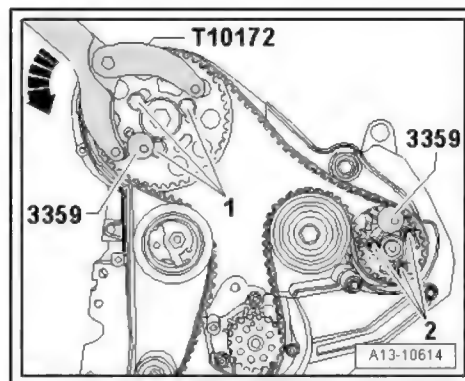


Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- Install vibration damper ⇒ [page 47](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - toothed belt", page 81](#)



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2 Cylinder head

⇒ "2.1 Exploded view - cylinder head", page 93

⇒ "2.2 Exploded view - cylinder head cover", page 95

⇒ "2.3 Removing and installing cylinder head", page 98

⇒ "2.4 Removing and installing cylinder head cover", page 107

⇒ "2.5 Removing and installing seals for injectors", page 110

⇒ "2.6 Checking compression", page 111

2.1 Exploded view - cylinder head

1 - Cylinder head gasket

- ☐ Renewing
⇒ "2.3 Removing and installing cylinder head", page 98
- ☐ Identification of cylinder head gasket
⇒ page 95
- ☐ If renewed, change coolant and engine oil

2 - Bolt

- ☐ Tightening torque
⇒ Item 2 (page 305)

3 - Hall sender - G40-

- ☐ For camshaft position
- ☐ Removing and installing
⇒ page 307

4 - Cylinder head

- ☐ Removing and installing
⇒ page 98
- ☐ To prevent damage to glow plugs, always place cylinder head on a soft foam surface after removal.
- ☐ Checking for distortion
⇒ page 95
- ☐ Must not be machined
- ☐ Before installing, check that the two dowel sleeves for centring cylinder head are fitted on cylinder block
- ☐ If renewed, change coolant and engine oil

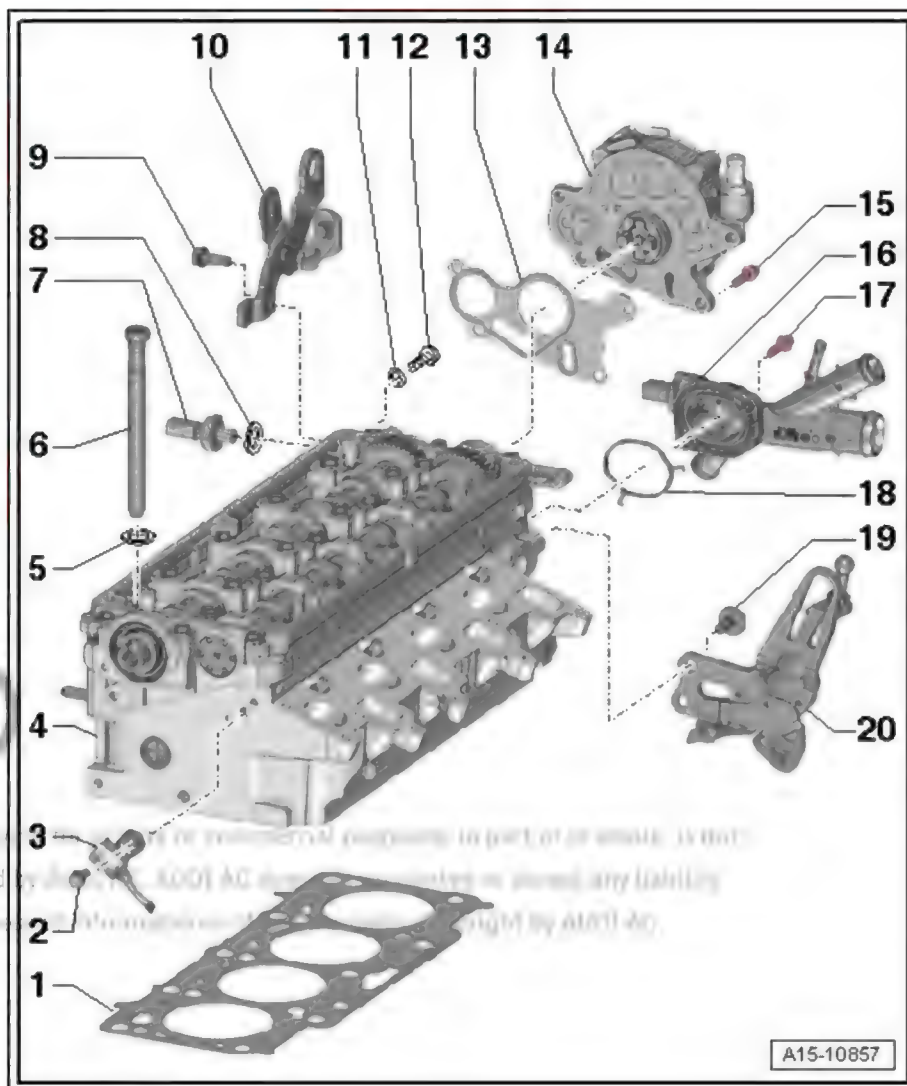
5 - Washer

6 - Bolt

- ☐ Renew
- ☐ Correct sequence when slackening ⇒ page 103
- ☐ Tightening torque and sequence ⇒ page 94

7 - Oil pressure switch - F1-

- ☐ Opening/closing pressure 0.3 ... 0.6 bar





☐ Removing and installing ⇒ [page 146](#)

☐ Checking ⇒ [page 149](#)

☐ 20 Nm

8 - Seal

☐ Renew (cut seal open to do so)

9 - Bolt

☐ 20 Nm

10 - Engine lifting eye

11 - Seal

☐ Renew

12 - Plug

☐ 20 Nm

13 - Gasket

☐ Renew

14 - Vacuum pump

☐ Removing and installing ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump

15 - Bolt

☐ Tightening torque ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Exploded view - vacuum pump

16 - Connection

☐ For coolant hoses

☐ with coolant temperature sender - G62-

☐ Version fitted in vehicle may differ from illustration

17 - Bolt

☐ Tightening torque ⇒ [Item 12 \(page 179\)](#)

18 - Seal

☐ Renew

19 - Bolt

☐ 20 Nm

20 - Engine lifting eye

Cylinder head - tightening torque and sequence

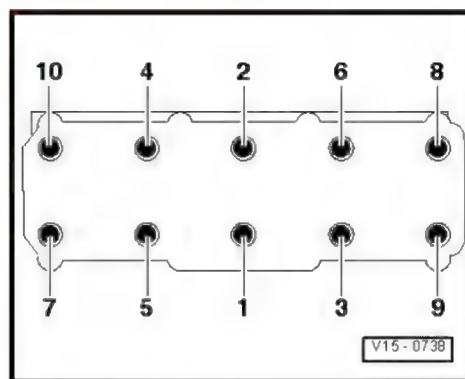


Note

Renew the bolts tightened with specified tightening angle.

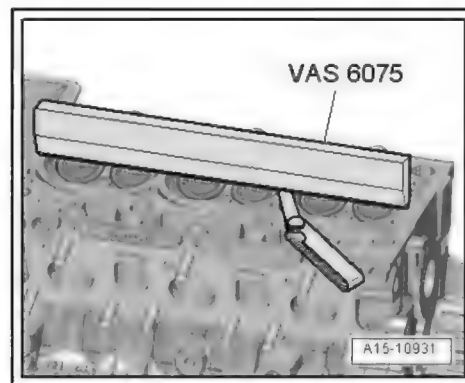
– Tighten bolts in 4 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 10-	30 Nm
2.	-1 ... 10-	50 Nm
3.	-1 ... 10-	Turn 90° further
4.	-1 ... 10-	Turn 90° further



Checking cylinder head for distortion

- Use straight edge 500 mm - VAS 6075- and feeler gauge to measure cylinder head for distortion at several points.
- Max. permissible distortion: 0.1 mm.



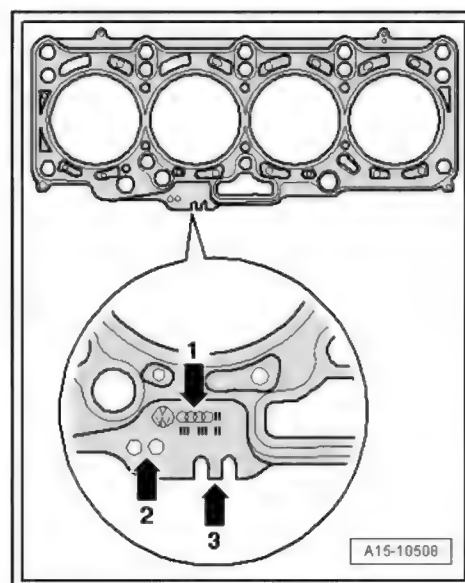
Identification of cylinder head gasket

- 1 - Part number
- 2 - Holes
- 3 - Ignore



Note

Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection ➔ [page 77](#). When renewing only the cylinder head gasket, the new gasket should have the same identification as the old one.



2.2 Exploded view - cylinder head cover



Caution

When installing a new base engine, it is essential that the clamping pieces for the injectors are tightened to the specified torque ➔ [page 236](#) after installing the high-pressure pipes. The clamping pieces are only secured hand-tight at the factory so the injectors can be aligned during installation. If these instructions are not observed, the engine could be damaged.

1 - Gasket

- ☐ Renew if damaged or leaking

2 - Cylinder head cover

- ☐ Removing and installing ➔ [page 107](#)

3 - Bracket

- ☐ For vacuum lines and electrical wiring

4 - O-ring

- ☐ Check and renew if necessary; if O-ring is not available, renew hose

5 - Hose

- ☐ For crankcase breather
- ☐ Press release tabs to detach

6 - Sealing bush

- ☐ For fuel rail
- ☐ Renew if damaged or leaking

7 - Grommet

8 - Clamping piece

9 - Bolt

- ☐ Tightening torque ➔ [Item 16 \(page 239\)](#)

10 - Fuel rail

- ☐ Observe rules for cleanliness ➔ [page 5](#)
- ☐ Do not attempt to bend high-pressure pipes to a different shape
- ☐ Installing high-pressure pipes ➔ [page 250](#)

11 - Bolt

- ☐ Tightening torque ➔ [Item 10 \(page 238\)](#)

12 - Bolt

- ☐ Tightening torque ➔ [Item 7 \(page 237\)](#)

13 - Fuel return line

14 - O-ring

- ☐ Renew

15 - Injector

- ☐ Observe rules for cleanliness ➔ [page 5](#)
- ☐ Removing and installing ➔ [page 246](#)

16 - O-ring

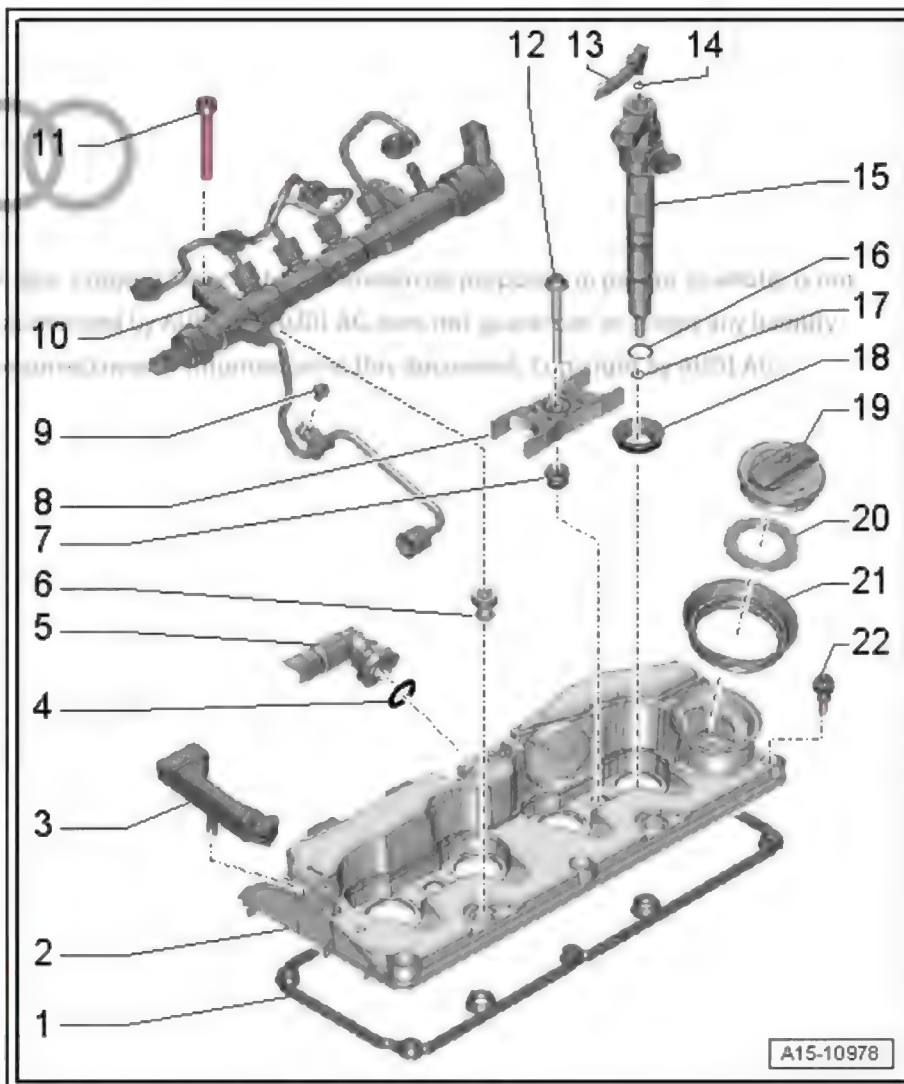
- ☐ Renew

17 - Copper seal

- ☐ Renew

18 - Seal

- ☐ For injector





☐ Renewing ➔ [page 110](#)

19 - Filler cap

20 - Seal

☐ For filler cap

21 - Grommet

22 - Bolt

☐ Renew if seal is damaged

☐ Tightening torque and sequence ➔ [page 97](#)

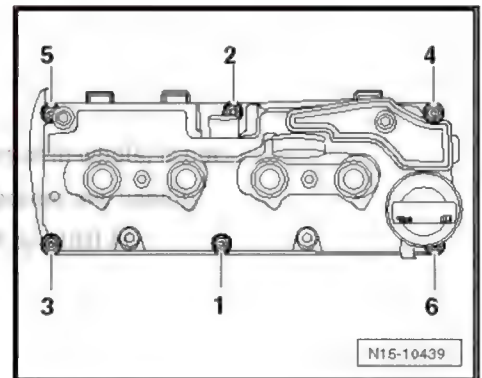
Cylinder head cover - tightening torque and sequence

— Tighten bolts for cylinder head cover in the sequence -1 ... 6- to 9 Nm.



Note

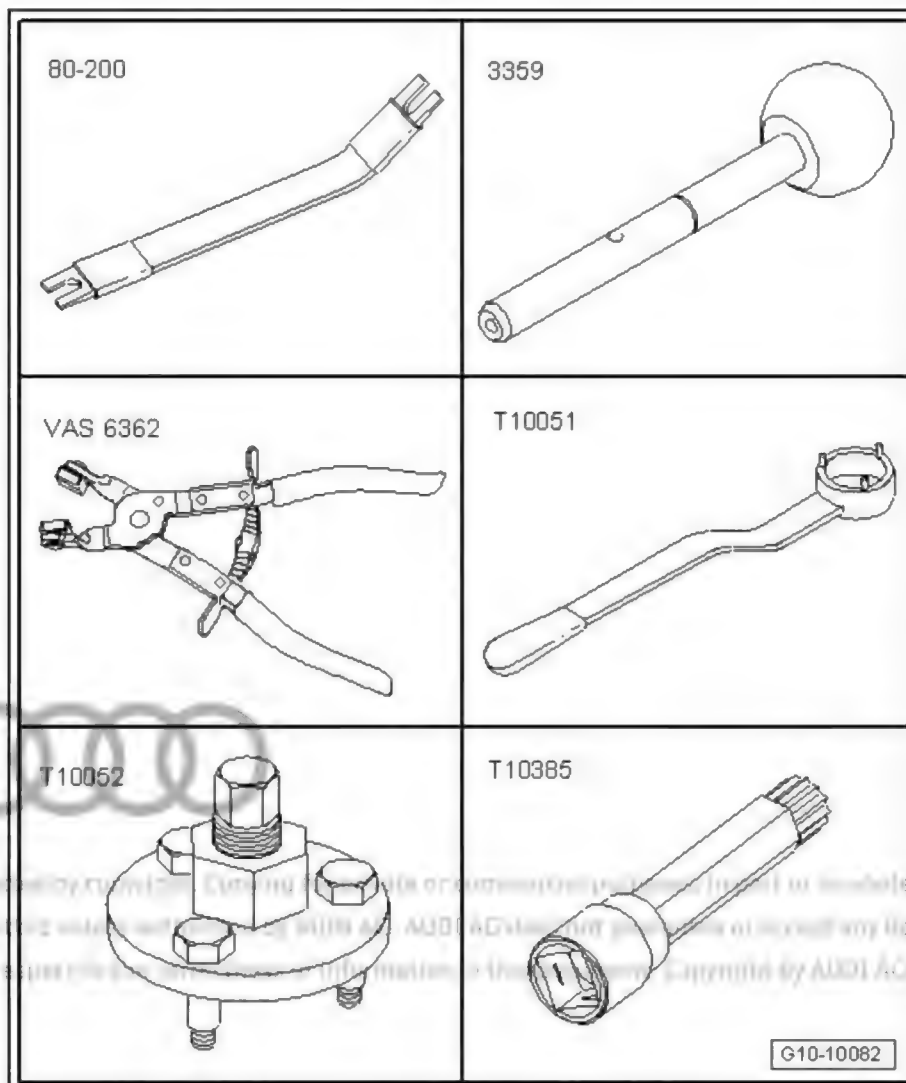
Take care to keep cylinder head cover straight.





2.3 Removing and installing cylinder head

Special tools and workshop equipment required



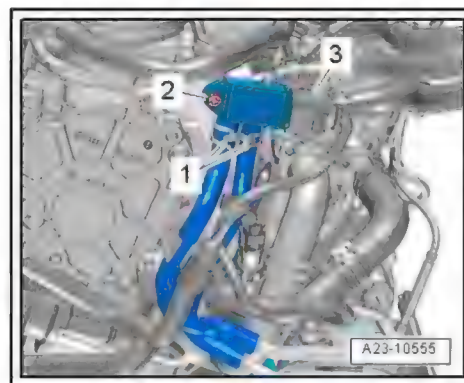
- ◆ Removal lever - 80 - 200-
- ◆ Diesel injection pump locking pin - 3359-
- ◆ Hose clip pliers - VAS 6362-
- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Bit XZN 10 - T10385-

Removing

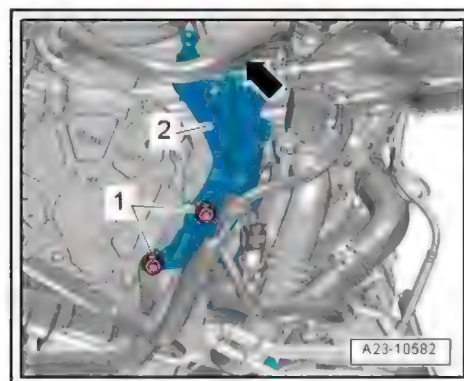
- Remove plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .
- Remove air cleaner housing ⇒ [page 227](#) .
- Remove toothed belt ⇒ [page 83](#) .
- Remove coolant pipe (top left) ⇒ [page 181](#) .



- Unplug electrical connector -3- for pressure differential sender - G505- .
- Remove bolt -2- and move hoses -1- clear at bracket.
- Move pressure differential sender - G505- to rear.



- Move clear electrical wiring harness -arrow-.
- Remove nuts -1- and detach bracket -2-.

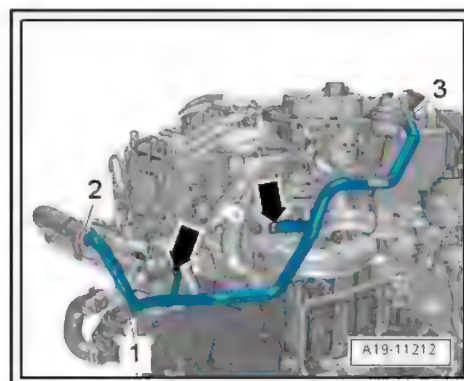


- Remove bolt and nut -arrows-.
- Release hose clip -3- and detach coolant hose.
- Press coolant pipe (rear right) to one side.



Note

Disregard items -1 and 2-.

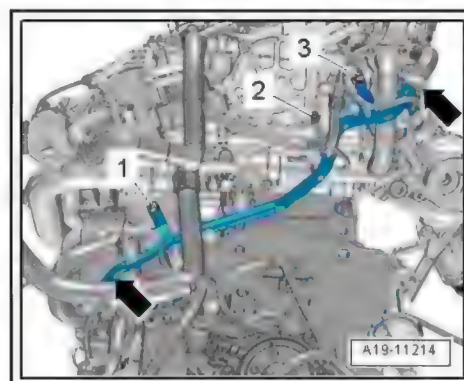


- Unplug electrical connector -3-.
- Remove bolt -1-.
- Release hose clips -arrows- and disconnect coolant hoses from rear coolant pipe.
- Move coolant pipe to rear.



Note

Disregard -item 2-.



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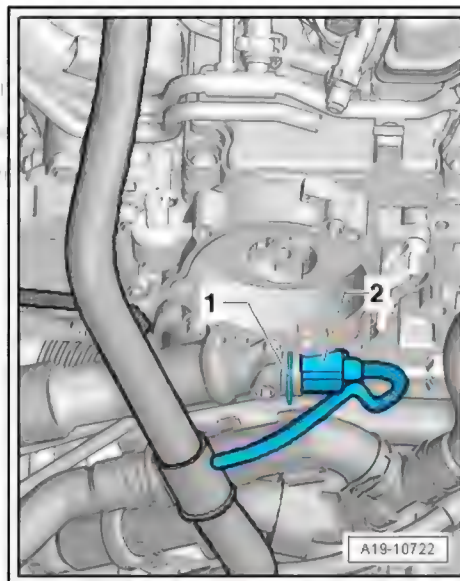
- Unplug electrical connector -2- at coolant temperature sender - G62- .

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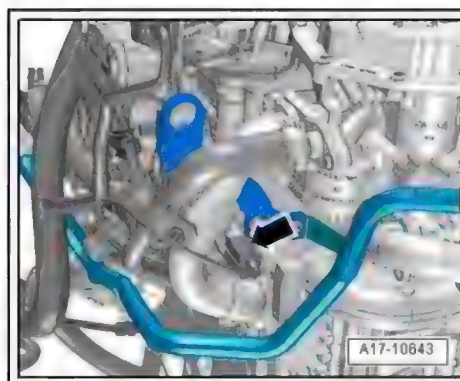


Note

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- Unplug electrical connector -arrow- on oil pressure switch - F1- .



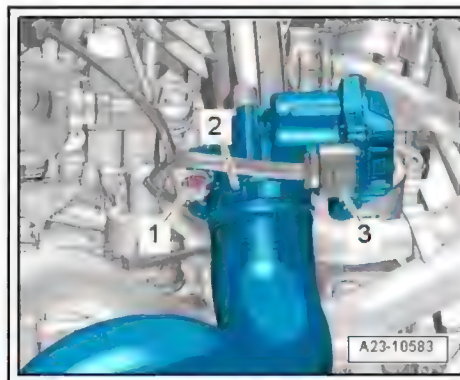
- Remove bolt -1- for dipstick guide tube.
- Unplug electrical connector -3- at throttle valve module - J338- .



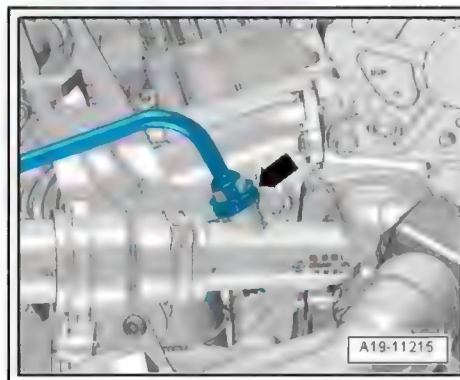
Note

Disregard -item 2-.

- Remove cylinder head cover ⇒ [page 107](#) .



- Lift retaining clip -arrow- and disconnect coolant line.



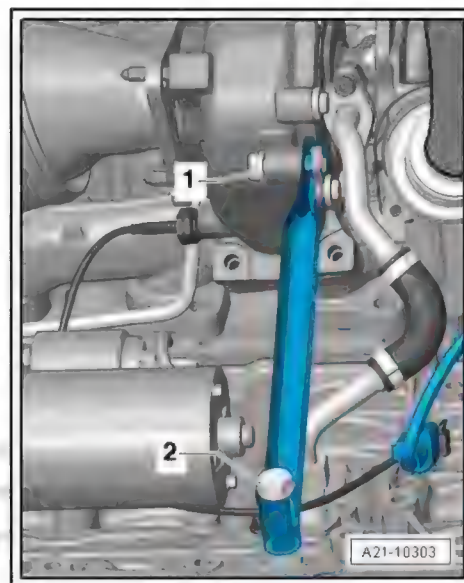
- Loosen bolt -1- for turbocharger.



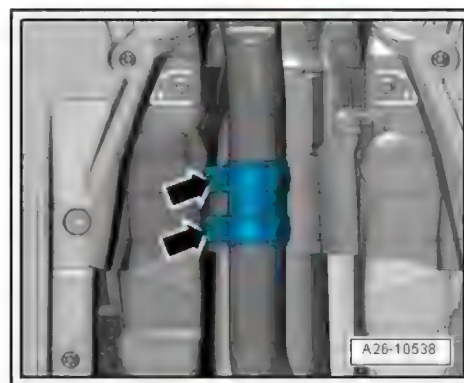
Disregard -item 2-.



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- Slacken clamp -arrows-.

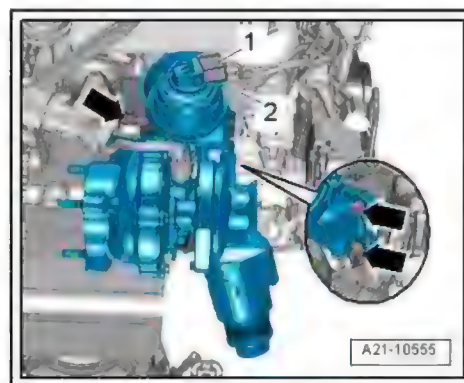


- Remove nuts -arrows- for turbocharger.

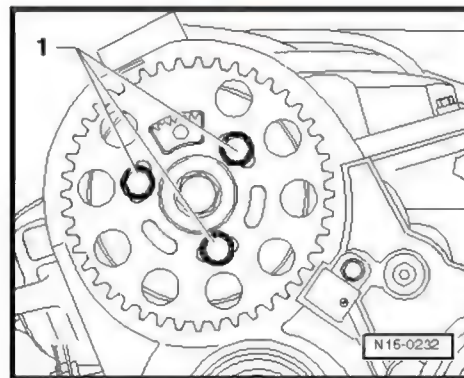


Disregard items -1 and 2-.

- Move clear electrical wiring harness at cylinder head.

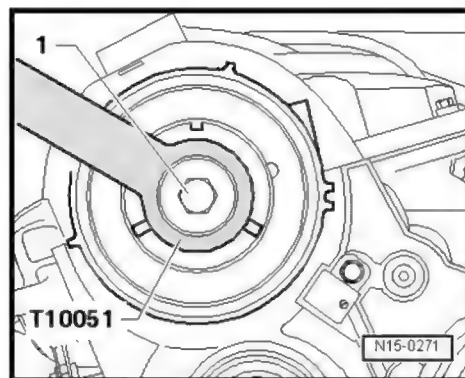


- Remove bolts -1- and detach camshaft sprocket.

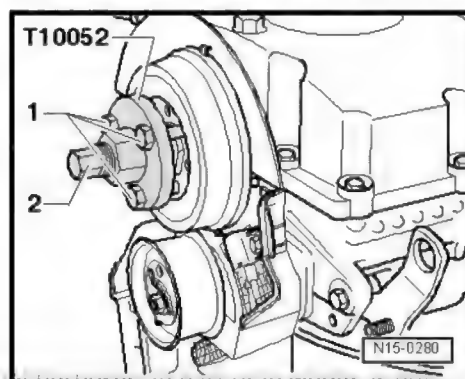




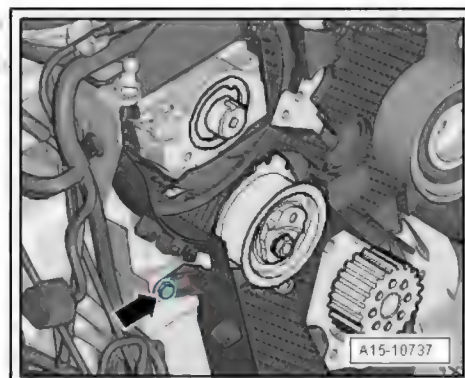
- Counterhold using counterhold tool - T10051- and loosen bolt -1- for camshaft hub.
- Unscrew bolt approx. 2 turns.



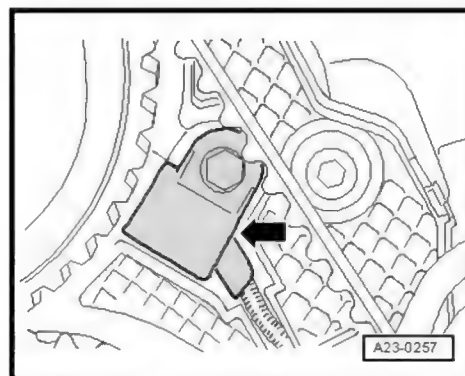
- Apply puller - T10052- to camshaft hub and screw bolts -1- into hub.
- Counterhold on hexagon flats (30 mm) of puller and screw in bolt -2- to pull off camshaft hub.
- Detach hub from taper of camshaft.



- Remove bolt -arrow- for toothed belt cover (rear).



- Remove bolt for Hall sender - G40- -arrow- and move Hall sender - G40- to one side.

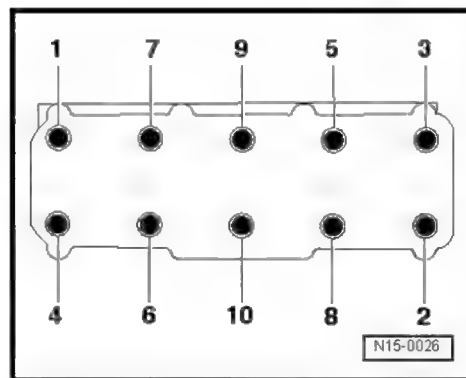


- Slacken cylinder head bolts in the sequence -1 ... 10-.



Note

- ◆ *A second mechanic is required for removal of the cylinder head.*
- ◆ *Toothed belt tensioning roller is detached from stud when lifting out cylinder head.*
- Swivel cylinder head towards front and out of rear toothed belt cover and detach tensioning roller at the same time.
- Take care not to damage oil return line for turbocharger.
- Take care to place cylinder head down without bending oil return line. If necessary, place a block of wood below exhaust manifold.



Caution

Risk of damage to glow plugs when putting down cylinder head.

- ◆ *After removal, the cylinder head must not be put down on the gasket side with the glow plugs still installed, because the glow plugs project slightly beyond the gasket surface.*



Note

Audi A6 models with 2.0 ltr. 4-valve common rail TDI engine are always equipped with steel glow plugs.

Installing

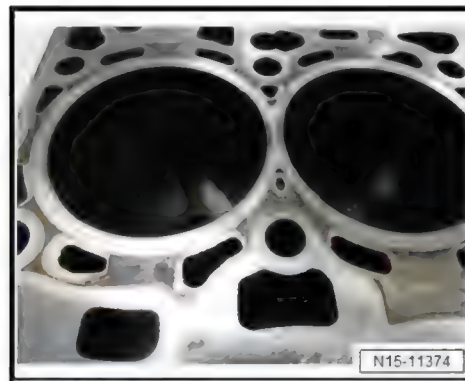


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Note

- ◆ *Use of impermissible abrasive materials can lead to subsequent damage to the turbocharger, conrod bearings or similar.*
 - ◆ *Do NOT use abrasive materials (sandpaper, sanding discs, sanding pads, abrasive web, wire wool, etc.).*
 - ◆ *Sealing surface (see photo) must not be raised.*
 - ◆ *Dark discolouration (see photo) does not have to be removed.*
 - ◆ *When removing sealant residue, make sure none of the residue enters the open channels of the engine.*
 - ◆ *Ensure that nearby workspaces are kept clean and that the abrasive materials listed above are not being used there.*
- Sealant residue may only be removed from the cylinder head and cylinder block using a commercially available blade scraper.
 - Sealing surfaces must NOT be damaged.
 - No oil or coolant must be allowed to remain in the blind holes for the bolts.
 - Do not remove new cylinder head gasket from packaging until it is ready to be fitted.
 - If a new cylinder head is installed, the contact surfaces between the roller rocker fingers and the running surface of the cam must be lubricated.
 - Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.
 - Turn the crankshaft carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
 - After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.
 - Remove loose residue with a lint-free cloth.
 - Before fitting cylinder head, remove crankshaft stop - T10050- and turn crankshaft against normal direction of rotation until all pistons are positioned approximately equally below "TDC".
 - If not already fitted, install dowel sleeves for centring cylinder block and cylinder head in cylinder block.



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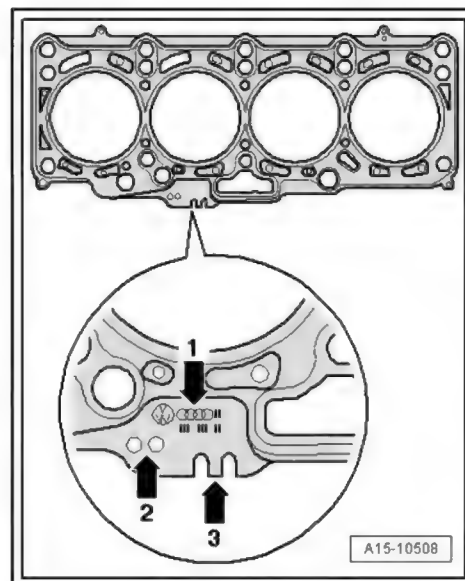
– Note cylinder head gasket identification:

- 1 - Part number
- 2 - Holes
- 3 - Ignore



Note

- ♦ If the cylinder head gasket or cylinder head have been replaced, select the new cylinder head gasket according to the number of holes on the old gasket.
- ♦ If parts of the crankshaft drive have been renewed, the new cylinder head gasket must be selected by measuring the piston projection at "TDC" ⇒ [page 77](#).

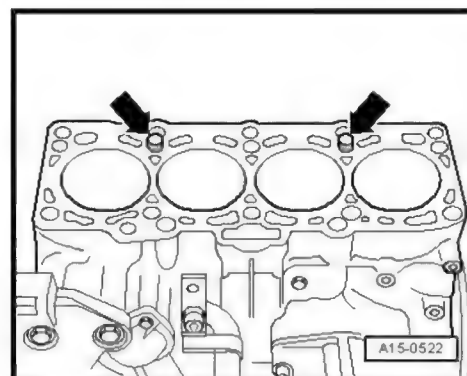


- Fit cylinder head gasket onto dowel sleeves -arrows- in cylinder block.
- Installation position of cylinder head gasket: the word "oben" (top) or the part number should face towards the cylinder head.
- Swivel cylinder head so that stud for toothed belt tensioning roller is inserted into aperture in toothed belt cover (rear) and attach tensioning roller at the same time.

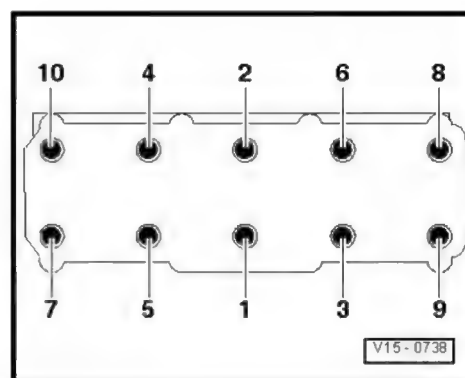


Note

Make sure that electrical wiring to Hall sender - G40- is properly routed.



- Fit cylinder head.
- Screw in cylinder head bolts by hand until they make contact.
- Tighten cylinder head bolts ⇒ [page 94](#).
- Install rear toothed belt cover, camshaft hub and sprocket ⇒ [page 81](#).



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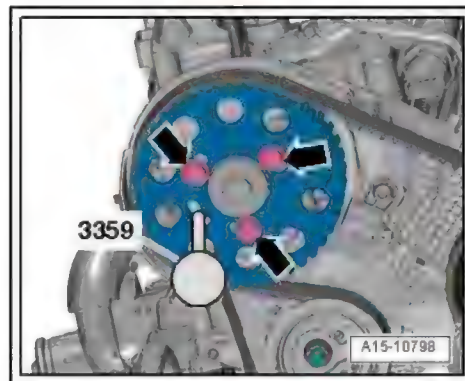


- Lock camshaft hub with diesel injection pump locking pin - 3359- .



Note

Disregard -arrows-.

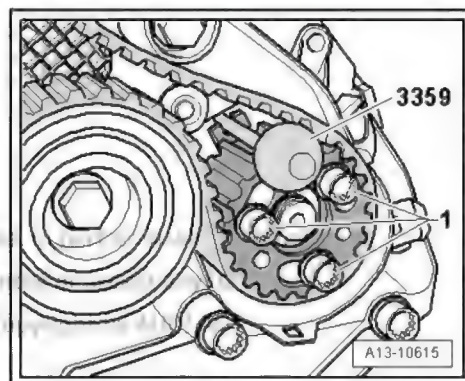


- Lock high-pressure pump hub with diesel injection pump locking pin - 3359- .



Note

Disregard -item 1-.

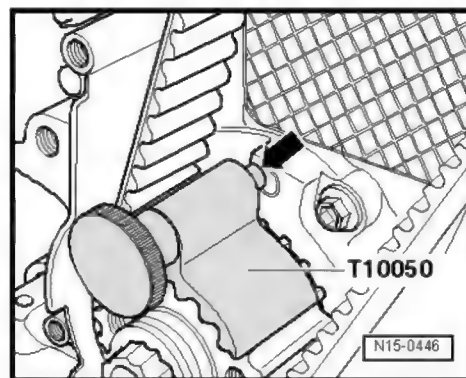




- Then turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop - T10050- engages in sealing flange as crankshaft rotates.
- Install toothed belt (adjust valve timing) ⇒ [page 87](#) .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install cylinder head cover ⇒ [page 107](#) .
- Install turbocharger ⇒ [page 203](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install coolant pipe (rear) ⇒ [page 185](#) .
- Install coolant pipe (rear right) ⇒ [page 183](#) .
- Install pressure differential sender - G505- ⇒ [page 282](#) .
- Install coolant pipe (top left) ⇒ [page 181](#) .
- Install air cleaner housing ⇒ [page 227](#) .
- Install plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .
- Change engine oil ⇒ Maintenance ; Booklet 411 .
- Fill cooling system with fresh coolant ⇒ [page 164](#) .



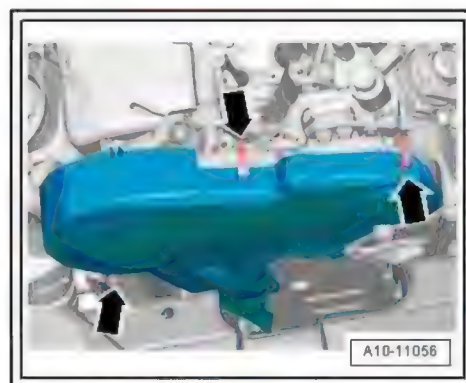
Tightening torques

- ◆ ⇒ ["2.1 Exploded view - cylinder head", page 93](#)
- ◆ ⇒ [Fig. "Cylinder head cover - tightening torque and sequence", page 97](#)
- ◆ Dipstick guide tube
⇒ ["1.1 Exploded view - sump/oil pump", page 135](#)
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system", page 209](#)

2.4 Removing and installing cylinder head cover

Removing

- Remove injectors ⇒ [page 246](#) .
- Remove fuel rail ⇒ [page 251](#) .
- Release retaining clips -arrows- and detach toothed belt cover (top).





- Unplug electrical connectors -2, 3, 4- and move electrical wiring clear.
- Detach vacuum hose -1- and move clear.



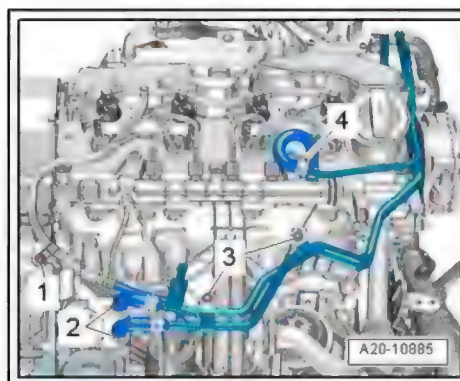
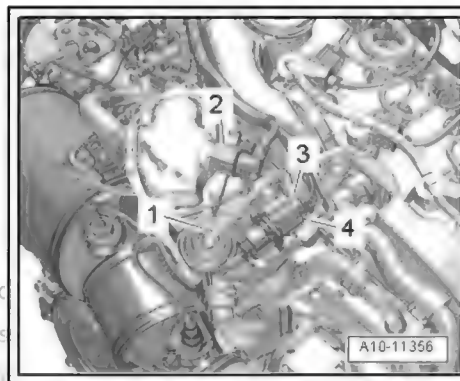
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- Remove bolts -1, 3-.
- Release hose clips -2- and detach fuel hoses.
- Pull fuel lines upwards off cylinder head cover and press clear to one side.

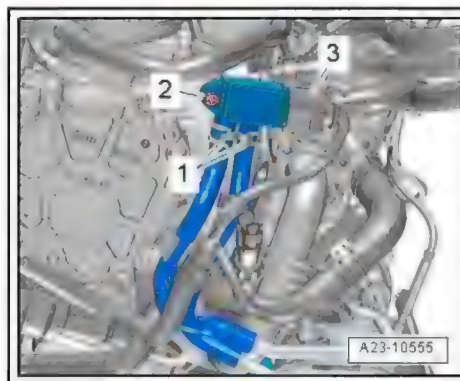


Note

Disregard -item 4-.



- Unplug electrical connector -3- for pressure differential sender - G505- .
- Remove bolt -2- and move hoses -1- clear at bracket.
- Move pressure differential sender - G505- to rear.

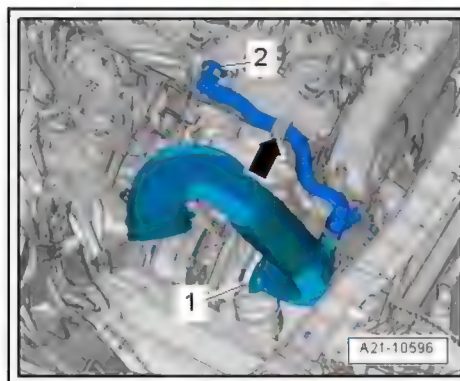


- Press release tabs, disconnect crankcase breather hose -2- and move hose clear -arrow-.



Note

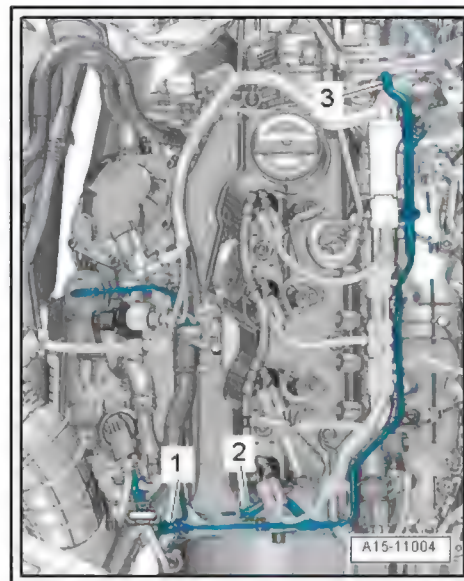
Disregard -item 1-.



- Disconnect vacuum hose -2-.
- Detach bracket -1- for vacuum lines and electrical wiring from cylinder head cover and move clear to one side.



Disregard -item 3-.



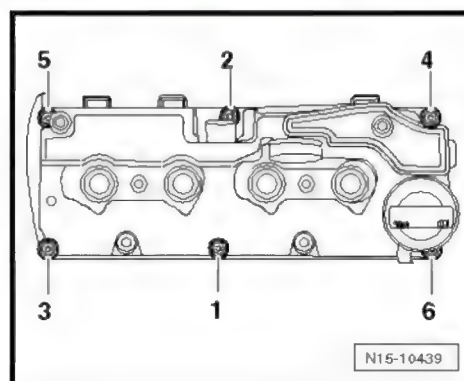
- Slacken cylinder head cover bolts in the sequence -6 ... 1- and remove.

Installing

Installation is carried out in reverse order; note the following:



- ◆ Fit new O-ring.
 - ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
 - ◆ Renew gasket for cylinder head cover and bolts for cylinder head cover if damaged or leaking.
 - ◆ Renew grommets and seals for injectors if damaged or leaking.
- Tighten cylinder head cover bolts ⇒ [page 97](#).





- Make sure that cylinder head cover is clipped properly to toothed belt cover -arrows-.



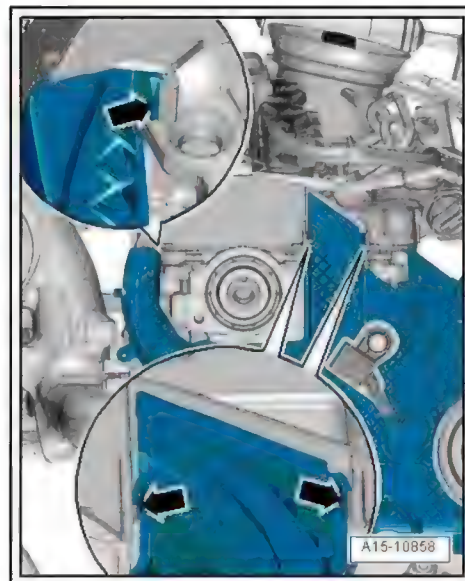
Note

For illustration purposes, the installation position is shown with the camshaft sprocket removed.

- Make sure there is a clearance between hub and toothed belt cover.
- Install fuel rail ⇒ [page 251](#) .
- Install injectors ⇒ [page 246](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Bleed fuel system
⇒ ["1.3 Filling and bleeding fuel system", page 222](#) .

Tightening torques

- ♦ ⇒ [Fig. "Cylinder head cover - tightening torque and sequence"](#) , [page 97](#)



2.5 Removing and installing seals for injectors

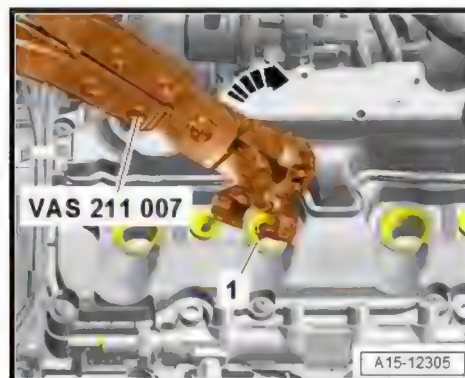
Special tools and workshop equipment required

- ♦ Pliers -VAS 211 007- (not illustrated)
- ♦ Carrier - 3390-



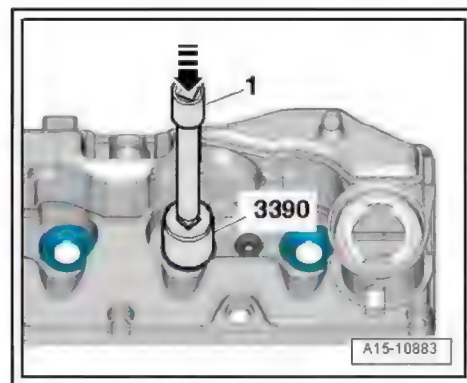
Procedure

- Remove corresponding injector
⇒ ["5.7 Removing and installing injectors", page 246](#) .
- Pull off seal -1- using pliers -VAS 211 007- -arrow-.





- Use suitable thrust piece (e.g. carrier - 3390-) and short extension -1- to press new injector seal in from above -arrow- as far as stop.



2.6 Checking compression

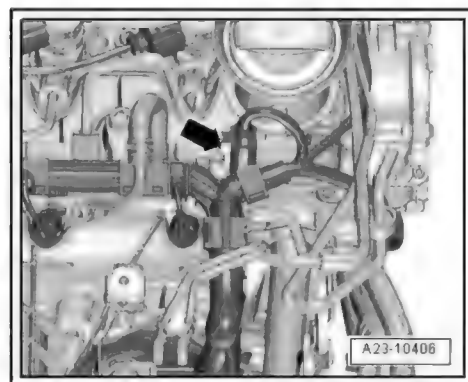
Special tools and workshop equipment required

- ◆ Compression tester - V.A.G 1763- with adapter - V.A.G 1763/8-



Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Remove engine cover panel ➔ [page 41](#) .
- Unplug electrical connector -arrow- for fuel pressure regulating valve - N276- at fuel rail.
- Briefly start engine to relieve fuel pressure in fuel rail.
- Remove all glow plugs ➔ [page 305](#) .



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- Screw in adapter - V.A.G 1763/8- in place of corresponding glow plug and connect compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ *Operating instructions* .

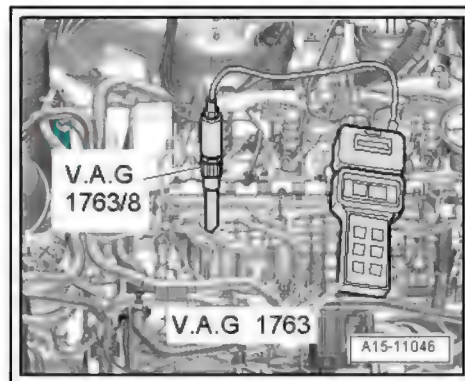
- Have a second mechanic operate starter until tester shows no further pressure increase.
- Repeat procedure on each cylinder.

Compression pressure	bar
When new	25.0 ... 31.0
Wear limit	19.0
Maximum difference between cylinders	5.0

Assembling

Installation is carried out in the reverse order; note the following:

- Install glow plugs ⇒ [page 305](#) .
- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester, Guided Functions, then Interrogate event memory.



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3 Valve gear

⇒ "3.1 Exploded view - valve gear", page 113

⇒ "3.2 Measuring axial clearance of camshaft", page 114

⇒ "3.3 Measuring radial clearance of camshaft", page 115

⇒ "3.4 Removing and installing camshaft oil seal", page 116

⇒ "3.5 Removing and installing camshaft", page 118

⇒ "3.6 Removing and installing valve stem oil seals", page 125

3.1 Exploded view - valve gear

1 - Valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Mark installation position for re-installation
- ☐ Checking ⇒ [page 134](#)
- ☐ Valve dimensions ⇒ [page 134](#)
- ☐ Checking valve guides ⇒ [page 133](#)

2 - Cylinder head

3 - Valve stem oil seal

- ☐ Renewing with cylinder head installed ⇒ [page 125](#)
- ☐ Renewing with cylinder head removed ⇒ [page 129](#)

4 - Valve spring

5 - Valve spring plate

6 - Valve cotters

7 - Sealing cap

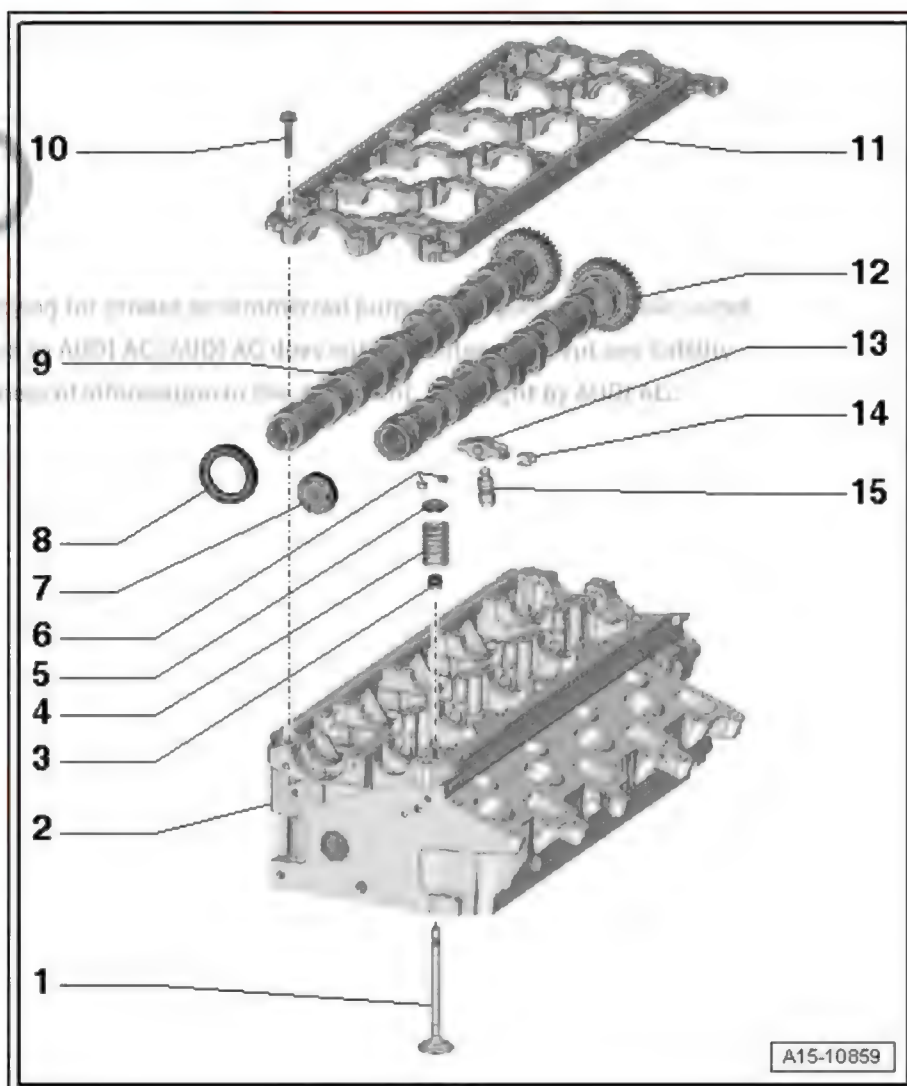
- ☐ Renew
- ☐ Removing sealing cap with retaining frame installed: pierce on one side with an awl and pry out
- ☐ Installing: drive in without sealant using suitable thrust piece
- ☐ Installation depth 1 ... 2 mm

8 - Oil seal

- ☐ Renewing ⇒ [page 116](#)

9 - Exhaust camshaft

- ☐ Removing and installing ⇒ [page 118](#)
- ☐ Measuring axial clearance ⇒ [page 114](#)
- ☐ Measuring radial clearance ⇒ [page 115](#)





10 - Bolt

- ☐ Correct sequence when slackening ⇒ [page 121](#)
- ☐ Tightening torque and sequence ⇒ [page 114](#)

11 - Retaining frame

- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ ["3.5 Removing and installing camshaft", page 118](#)

12 - Inlet camshaft

- ☐ Removing and installing ⇒ [page 118](#)
- ☐ Measuring axial clearance ⇒ [page 114](#)
- ☐ Measuring radial clearance ⇒ [page 115](#)

13 - Roller rocker finger

- ☐ Removing and installing ⇒ ["3.5 Removing and installing camshaft", page 118](#)
- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surfaces before installing

14 - Securing clip

- ☐ For hydraulic compensation element

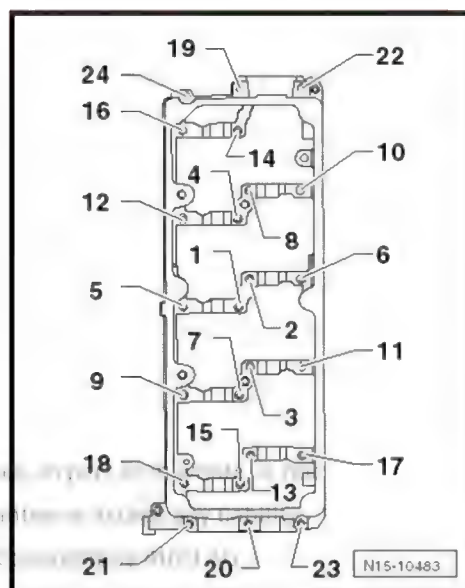
15 - Hydraulic compensation element

- ☐ Mark installation position for re-installation
- ☐ Lubricate contact surfaces before installing

Retaining frame - tightening torque and sequence

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 ... 24-	Screw in by hand until contact is made <ul style="list-style-type: none">• The retaining frame should make contact with the cylinder head over the full surface
2.	-1 ... 24-	10 Nm



3.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required



◆ Universal dial gauge bracket - VW 387-



◆ Dial gauge - VAS 6079-

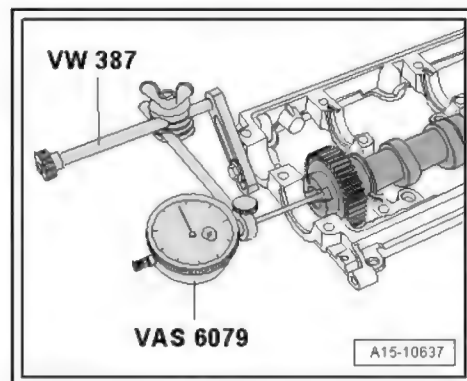


Procedure

- Remove retaining frame
⇒ ["3.5 Removing and installing camshaft", page 118](#) .
- Secure dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to retaining frame as shown in illustration.
- Press camshaft against dial gauge by hand.
- Set dial gauge to "0".
- Press camshaft away from dial gauge and read off value:

Axial clearance on inlet camshaft and exhaust camshaft:

- Specification: 0.048 ... 0.118 mm.
- Wear limit: 0.17 mm.



3.3 Measuring radial clearance of camshaft

Special tools and workshop equipment required

◆ Plastigauge

Procedure

- Remove roller rocker fingers
⇒ ["3.5 Removing and installing camshaft", page 118](#) .
- Clean bearings and bearing journals.
- Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or bearing shell to be measured.
- The Plastigauge must be positioned in the centre of the bearing.
- Fit retaining frame and tighten to 10 Nm without rotating camshafts ⇒ [page 114](#) .
- Remove retaining frame again.



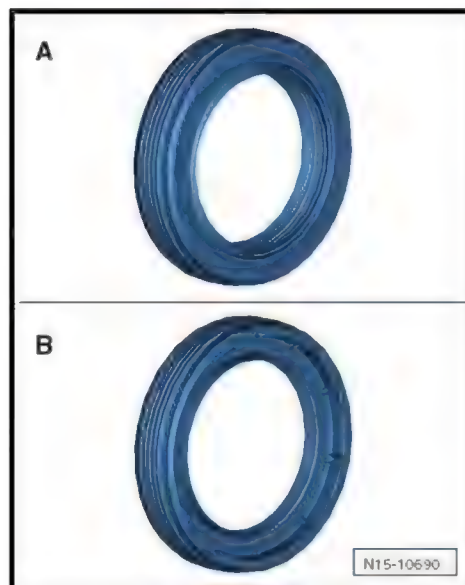
- Compare width of Plastigauge with measurement scale.
- Radial clearance: 0.035 ... 0.085 mm

3.4 Removing and installing camshaft oil seal



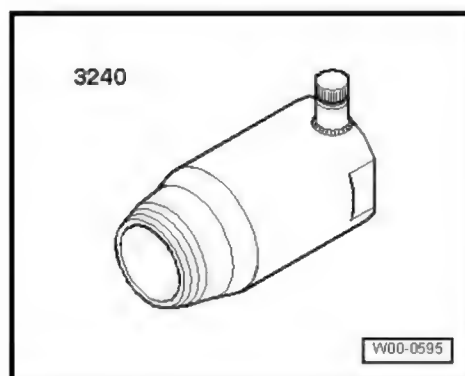
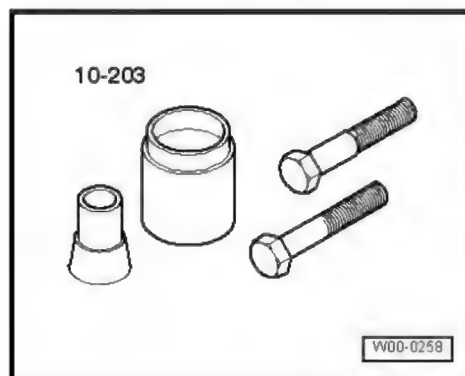
Note

- ◆ A modified oil seal is being phased in.
- ◆ The "old" version oil seal -item A- forms a continuous surface between the camshaft and the cylinder head.
- ◆ The "new" version oil seal -item B- has a shoulder between the camshaft and the cylinder head.



Special tools and workshop equipment required

- ◆ Fitting tool - 10 - 203-
- ◆ Oil seal extractor - 3240- for "old" version oil seal



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- ◆ Puller - T10443- for "new" version oil seal



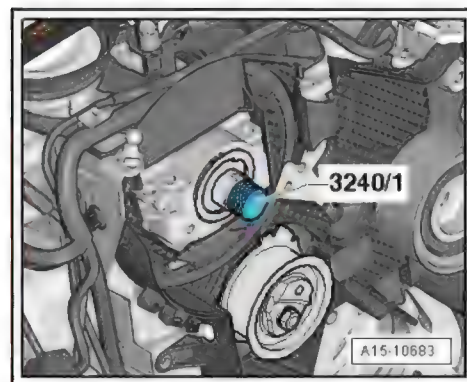
- ◆ Bolt M12x1.5x75

Procedure

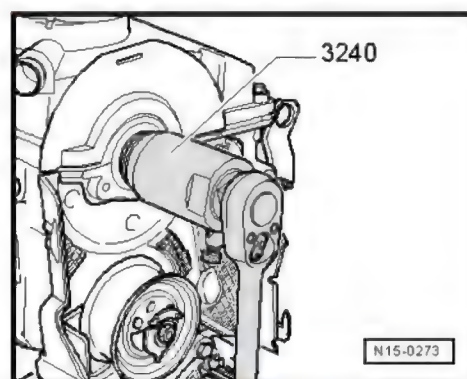
- Remove camshaft sprocket and hub
⇒ ["3.5 Removing and installing camshaft", page 118](#) .

"Old" version oil seal:

- Insert thrust piece -3240/1- in camshaft.



- Screw inner section of oil seal extractor -3240- two turns out of outer section (approx. 3 mm) and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.



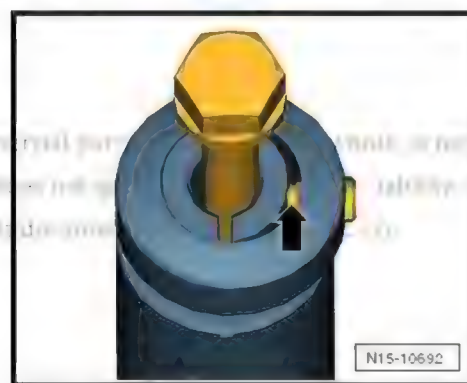
"New" version oil seal:



Caution

- ◆ *If the grub screw is unscrewed too far the thrust plate inside the puller -T10443- will come loose from the thrust bolt. If this happens, the thrust plate must be pushed back onto the thrust bolt.*

- Carefully unscrew grub screw -arrow- of puller -T10443- until slight resistance is felt.





- Apply puller - T10443- in a straight line, as shown in illustration, and lock by screwing in grub screw.-A-.
- Screw in thrust bolt -B- until oil seal is pulled out.

All types of oil seal (continued):

- Clean contact surface and sealing surface.

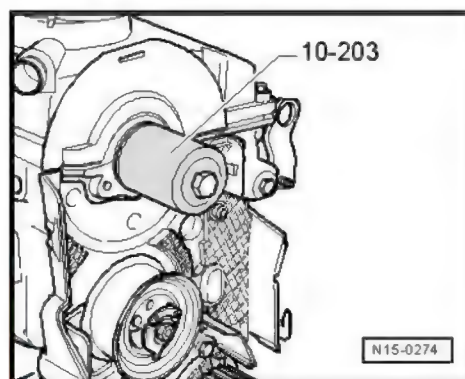
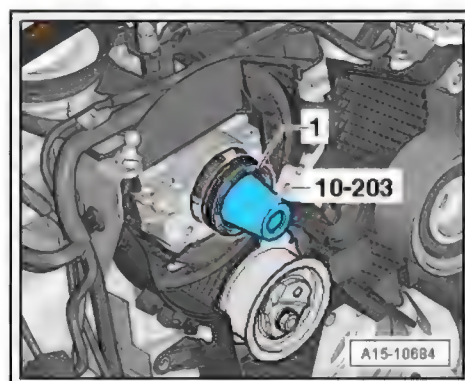
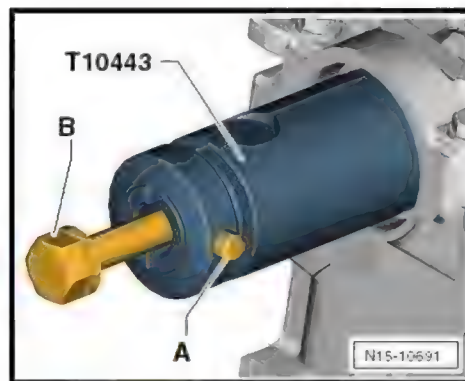


Note

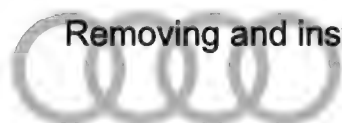
The sealing lip of the oil seal must not be additionally oiled or greased.

- Apply guide sleeve of fitting tool - 10 - 203- to camshaft as shown in illustration.
- Carefully push oil seal -1- over guide sleeve and onto camshaft.

- Press in oil seal onto stop using thrust piece of fitting tool - 10 - 203- and bolt M12×1.5×75.
- Install camshaft sprocket and hub
⇒ ["3.5 Removing and installing camshaft", page 118](#) .
- Install toothed belt (adjust valve timing) ⇒ [page 87](#) .

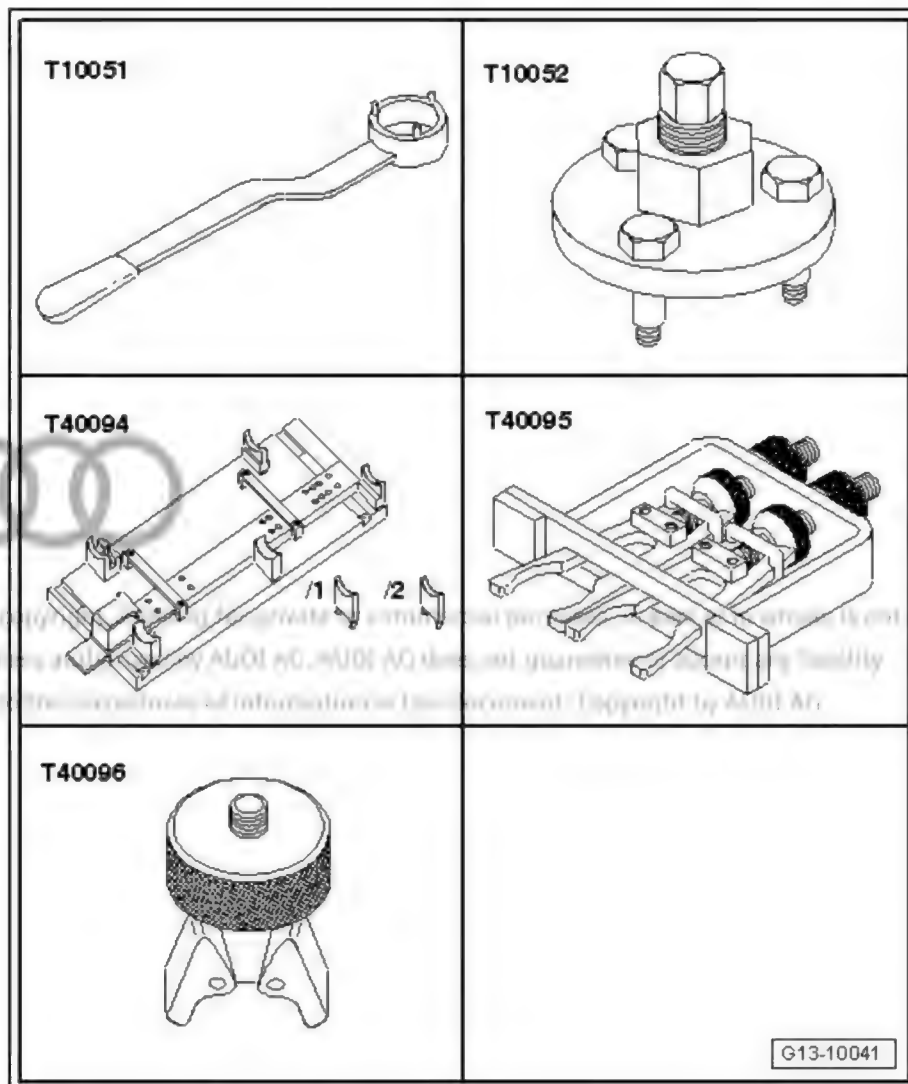


3.5 Removing and installing camshaft



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Special tools and workshop equipment required



- ◆ Counterhold tool - T10051-
- ◆ Puller - T10052-
- ◆ Camshaft fitting tool - T40094-
- ◆ Camshaft fitting tool - T40095-
- ◆ Clamping tool -T40096/1- for vehicles with two-piece camshaft gear
- ◆ Electric drill with plastic brush attachment
- ◆ Safety goggles
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

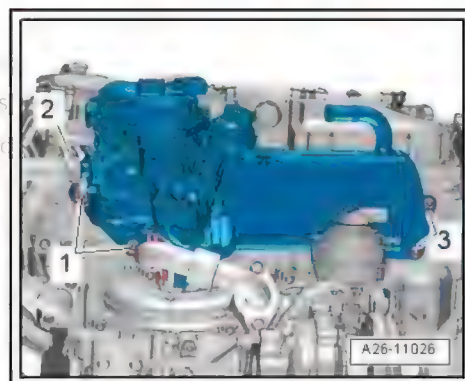
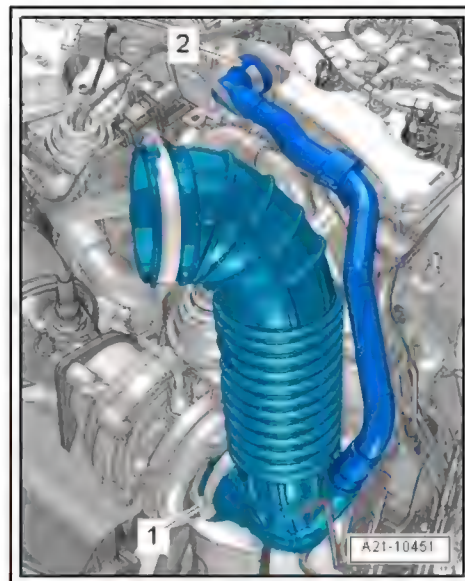
- Cylinder head installed.
- Remove engine cover panel ⇒ [page 41](#) .
- Take toothed belt off camshaft sprocket and high-pressure pump sprocket ⇒ [page 83](#) .
- Remove air cleaner housing ⇒ [page 227](#) .

- Press release tabs and detach crankcase breather hose -2-.
- Loosen hose clip -1- and remove air hose.
- Remove cylinder head cover ➔ [page 107](#) .

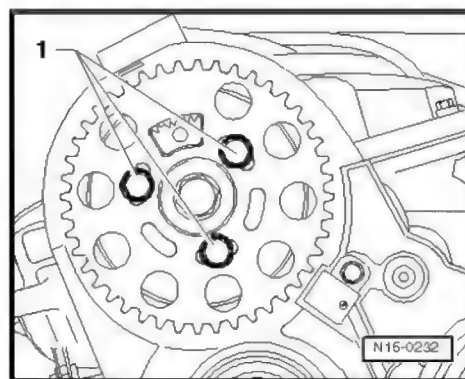


- Remove bolts -1, 3-; exhaust gas recirculation cooler remains installed.

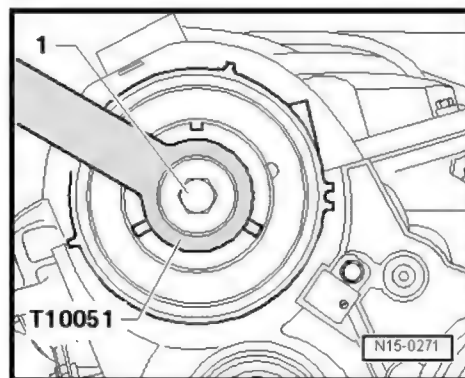
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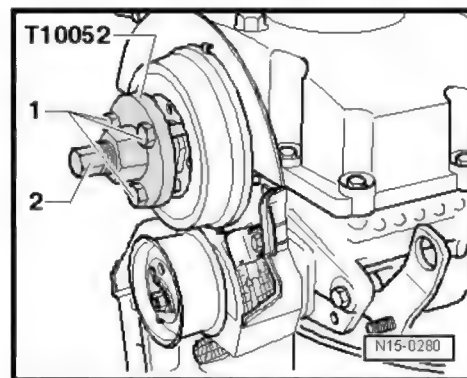
- Remove bolts -1- and detach camshaft sprocket.



- Counterhold using counterhold tool - T10051- and loosen bolt -1- for camshaft hub.
- Unscrew bolt approx. 2 turns.



- If it is not possible to take off the hub by hand:
- Apply puller - T10052- to camshaft hub and screw bolts -1- into hub.
- Counterhold on hexagon flats (30 mm) of puller and screw in bolt -2- to pull off camshaft hub.
- Detach hub from taper of camshaft.
- Remove vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .



- Slacken retaining frame bolts in the sequence -24 ... 1-.
- Remove bolts and carefully release retaining frame from bonded joint.
- Mark fitting location of camshafts for re-installation and re-remove.

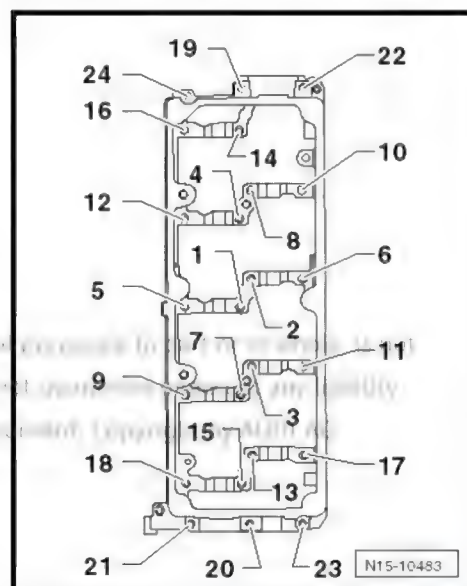
Installing



Caution

Make sure axial bearings in retaining frame are not damaged.

- ◆ *The camshafts **MUST** be installed using the camshaft fitting tool - T40094- as described in the following.*



Caution

Protect lubrication system and bearings against contamination.

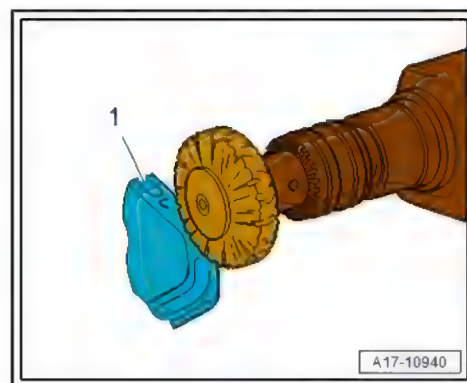
- ◆ *Cover exposed parts of the engine.*



WARNING

Risk of eye injury.

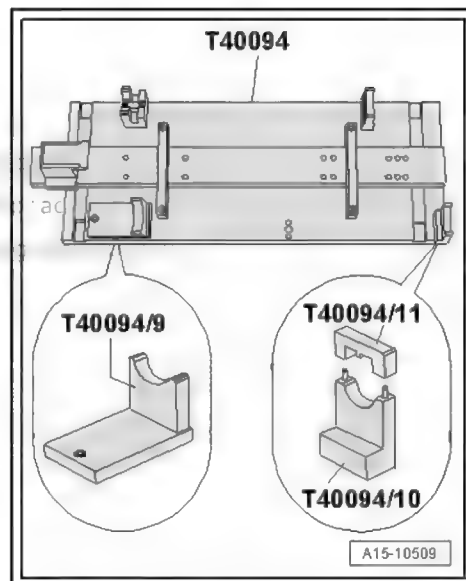
- ◆ *Put on safety goggles.*



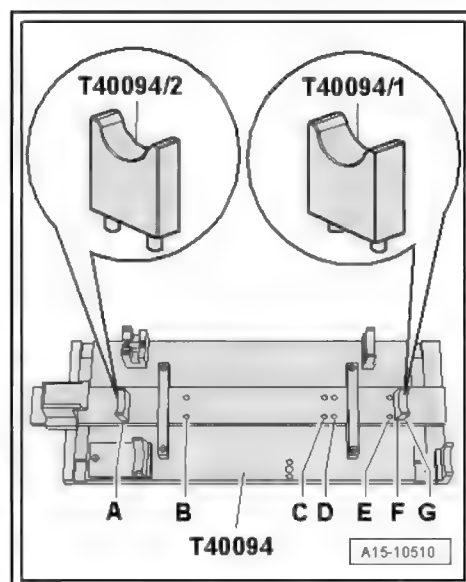
- Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Oil running surfaces of both camshafts.

Set up camshaft fitting tool - T40094- as follows:

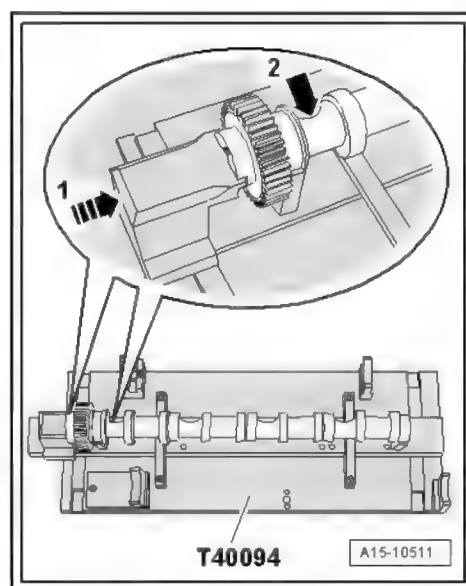
- Secure supports -T40094/9- and -T40094/10- (with -T40094/11-) to base plate, as shown in illustration. If necessary, remove any supports already attached at these positions.



- Fit support -T40094/1- onto position -F- and support -T40094/2- onto position -A-.



- Place inlet camshaft in supports -T40094/1- and -T40094/2- .
- Turn inlet camshaft in such a way that it can be locked in "TDC" position using locking device -arrow 1-.
- Recess -arrow 2- for cylinder head bolt must face outwards.





- Place exhaust camshaft in supports -T40094/9- and -T40094/10- .
- Lock exhaust camshaft with top section -T40094/11- .
- The lug -1- on the top section must engage in the slot -2- in the camshaft,

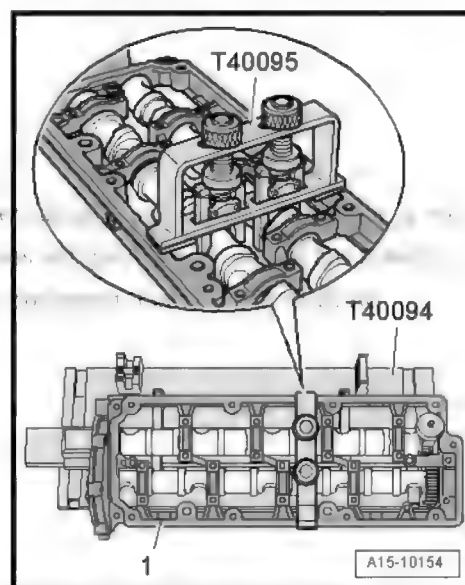
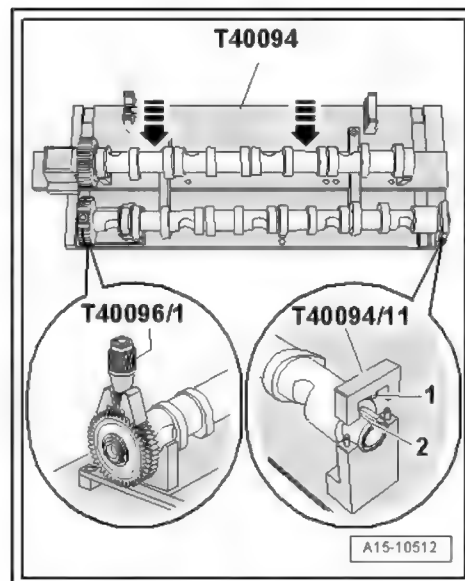
Vehicles with two-piece camshaft gear:

- Place clamping tool -T40096/1- on teeth of exhaust camshaft in such a way that the two arms of the tool engage on the two halves of the gear (one in each half, as shown in illustration).
- The wider arm must engage in the wider half of the gear.
- Tighten the clamping tool using the knurled wheel so that the faces of the gear teeth are in alignment.

All vehicles (continued):

- Slide inlet camshaft towards exhaust camshaft, until gear teeth engage -arrows-.

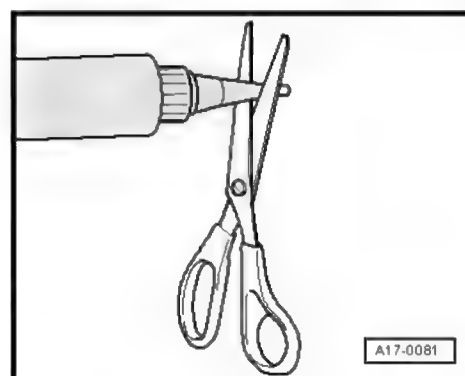
- Fit retaining frame on camshafts.
- All camshaft bearings must be seated on the camshafts.
- Position camshaft fitting tool - T40095- and fix camshafts in position in retaining frame, as shown in illustration.
- Detach top section -T40094/11- .



Note

Note the use-by date of the sealant.

- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).





Caution

Make sure excess sealant does not contaminate camshaft bearings.

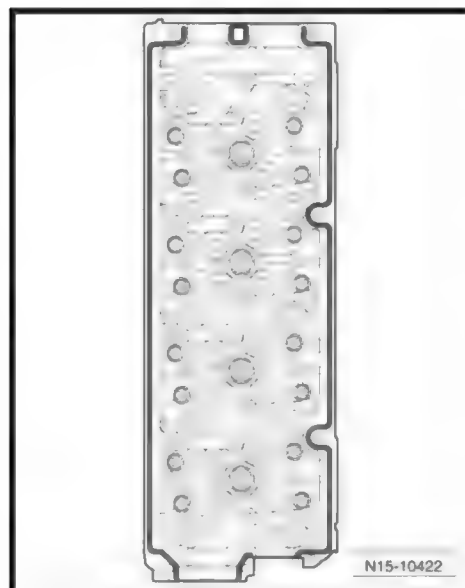
- ◆ *The sealant beads must not be thicker than specified.*

- Apply beads of sealant onto clean sealing surfaces of cylinder head as shown in illustration.
- Thickness of sealant beads: 2 ... 3 mm



Note

- ◆ *The retaining frame should be fitted and secured without delay, as the sealant starts hardening immediately.*
- ◆ *After installing the retaining frame, wait about 30 minutes for the sealant to dry.*
- Take camshafts together with retaining frame, camshaft fitting tool - T40095- and, if necessary, clamping tool -T40096/1- out of camshaft fitting tool - T40094- and insert components carefully into cylinder head.



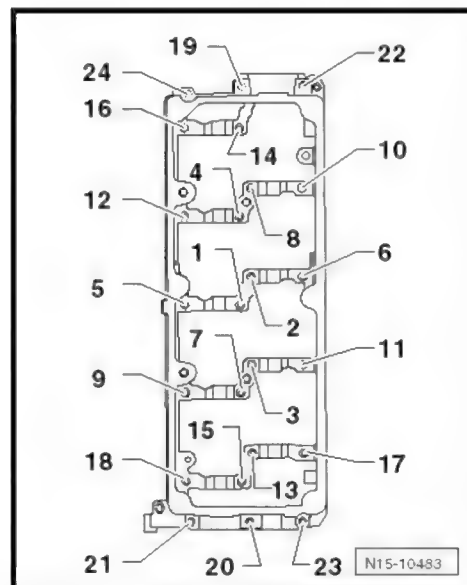
Technical description of the engine and its components is given in the "Technical description" section of the "Repair manual" for the engine.



- Screw in retaining frame bolts in the sequence -1 ... 24- evenly by hand until they make contact.
- The retaining frame should make contact with the cylinder head over the full surface.
- Tighten bolts ⇒ [page 114](#) .
- Remove camshaft fitting tool - T40095- and, if necessary, clamping tool -T40096/1- .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install camshaft oil seal ⇒ [page 116](#) .
- Drive new sealing cap ⇒ [Item 7 \(page 113\)](#) into cylinder head to a depth of approx. 1 ... 2 mm using suitable thrust piece.
- Install vacuum pump ⇒ Brake system; Rep. gr. 47 ; Vacuum system; Removing and installing vacuum pump .
- Install cylinder head cover ⇒ [page 107](#) .



Caution

Risk of damage to valves and piston crowns after working on valve gear.

- ◆ *The hydraulic tappets have to settle; wait for approx. 30 minutes after installing camshafts before starting engine.*
- ◆ *Turn the crankshaft carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

Tightening torques

- ◆ ⇒ [Fig. "Retaining frame - tightening torque and sequence"](#), [page 114](#)
- ◆ ⇒ ["3.1 Exploded view - valve gear"](#), [page 113](#)

3.6 Removing and installing valve stem oil seals

⇒ ["3.6.1 Removing and installing valve stem oil seals \(cylinder head installed\)"](#), [page 125](#)

⇒ ["3.6.2 Removing and installing valve stem oil seals \(cylinder head removed\)"](#), [page 129](#)

3.6.1 Removing and installing valve stem oil seals (cylinder head installed)

Special tools and workshop equipment required

◆ Valve stem seal puller - 3364-



◆ Valve stem seal fitting tool - 3365-



◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate for 3.0 ltr. TDI engine - VAS 5161/23- and sleeve -VAS 5161/23-1-



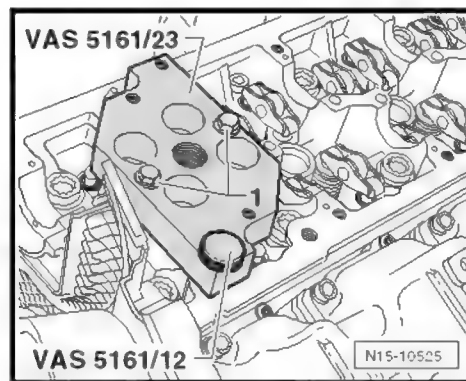
◆ Bolt, M6x30 (2x)

Procedure

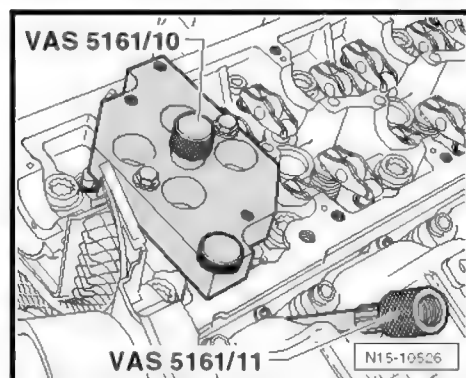
- Remove all glow plugs ⇒ [page 305](#) .
- Remove camshafts ⇒ [page 118](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Set piston of appropriate cylinder to "bottom dead centre".



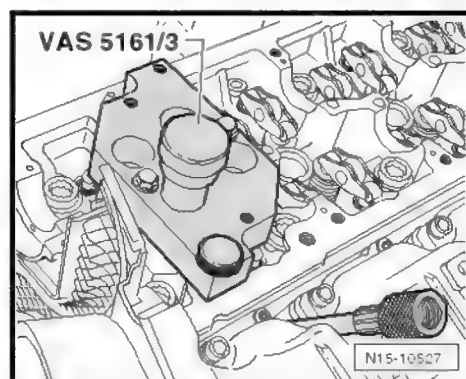
- Fit guide plate for 3.0 ltr. TDI engine - VAS 5161/23- onto cylinder head.
- Secure guide plate on intake manifold side with knurled screw -VAS 5161/12- and 2 M6x30 bolts -item 1- by hand until they make contact.



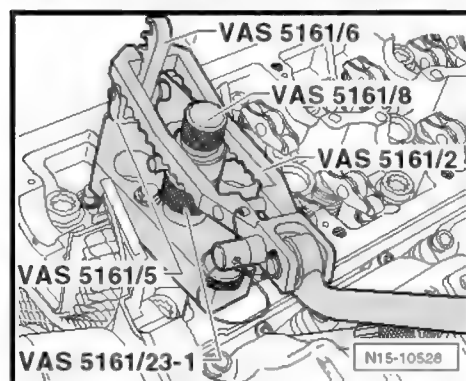
- Screw sealing pin -VAS 5161/10- into guide plate.
- Screw adapter -VAS 5161/11- hand-tight into corresponding glow plug thread.



- Insert drift -VAS 5161/3- into guide plate and use plastic-head hammer to release sticking valve cotters.

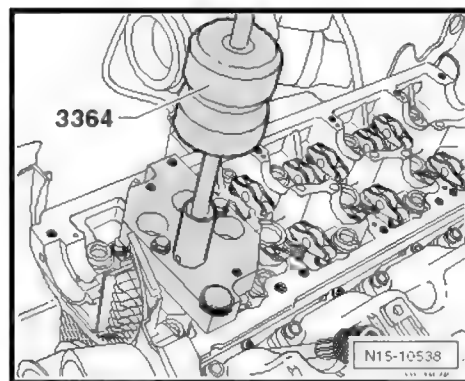


- Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
- Slide sleeve -VAS 5161/23-1- onto assembly cartridge -VAS 5161/8- .
- Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
 - Minimum pressure: 6 bar
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take off assembly cartridge with knurled spacer ring.
- Detach valve spring with valve spring plate.





- Pull off valve stem oil seal with valve stem seal puller - 3364- .

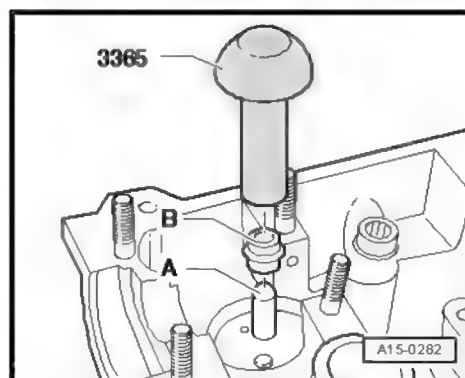


Caution

Make sure valve stem oil seals are not damaged when installing.

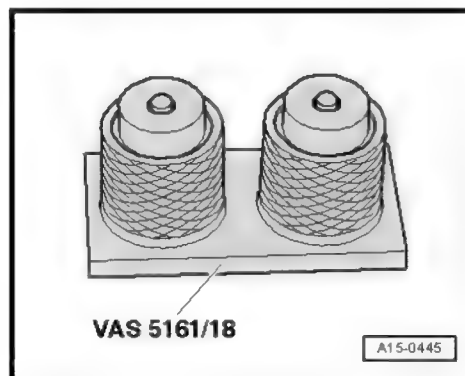
- ◆ *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*

- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Take off plastic sleeve.



If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.
- Insert valve spring and valve spring plate.
- Press assembly cartridge onto insertion device from above and take up valve cotters.

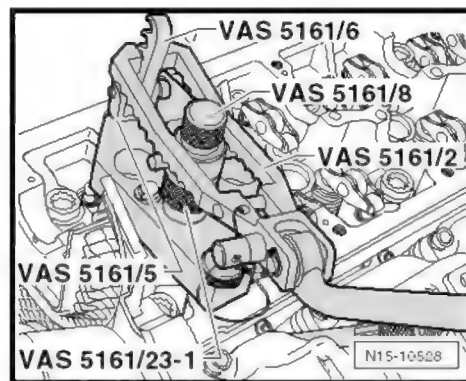


- Insert assembly cartridge in guide plate for 3.0 ltr. TDI engine - VAS 5161/23- again.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

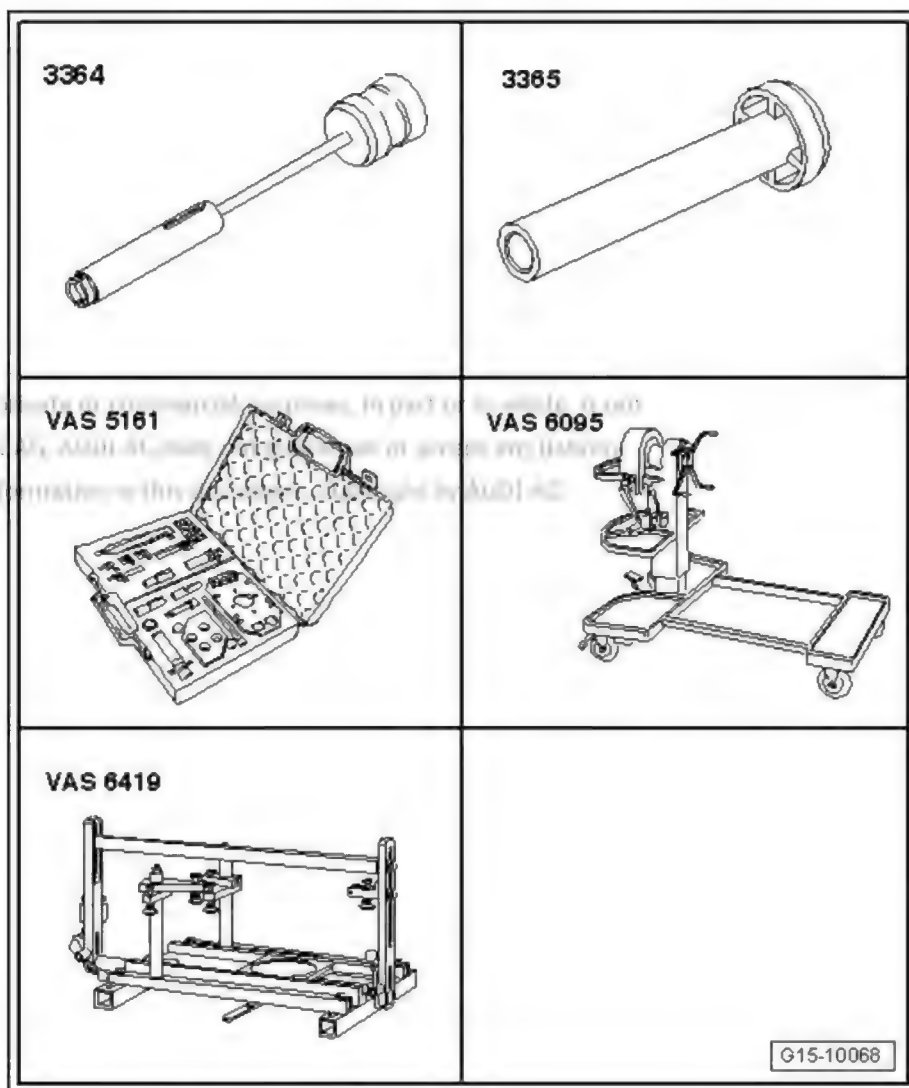
Installation is carried out in the reverse order; note the following:

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ➔ [page 118](#) .
- Install glow plugs ➔ [page 305](#) .



3.6.2 Removing and installing valve stem oil seals (cylinder head removed)

Special tools and workshop equipment required



◆ Valve stem seal puller - 3364-



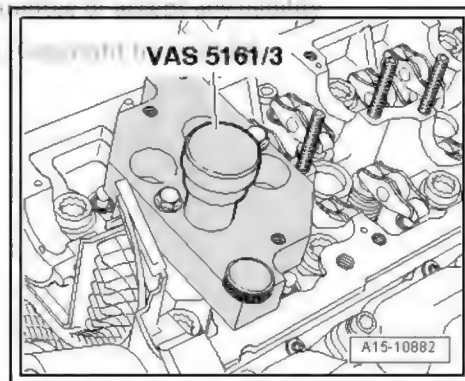
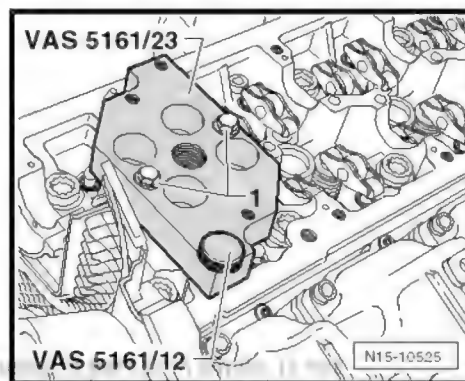
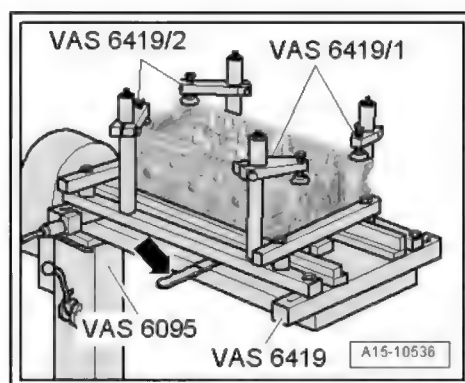
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device for valve cotters - VAS 5161 A- with guide plate for 3.0 ltr. TDI engine - VAS 5161/23- and sleeve -VAS 5161/23-1-
- ◆ Engine and gearbox support - VAS 6095-
- ◆ Cylinder head tensoning device - VAS 6419-
- ◆ Bolt, M6x30 (2x)

Procedure

- Remove camshafts ➔ [page 118](#) .
- Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
- Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
- Insert cylinder head tensoning device - VAS 6419- into engine and gearbox support - VAS 6095- .
- Secure cylinder head in cylinder head tensoning device, as shown in illustration.
- Connect cylinder head tensoning device to compressed air supply.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.
- Fit guide plate for 3.0 ltr. TDI engine - VAS 5161/23- onto cylinder head.
- Secure guide plate on intake manifold side with knurled screw -VAS 5161/12- and 2 M6x30 bolts -item 1- by hand until they make contact.

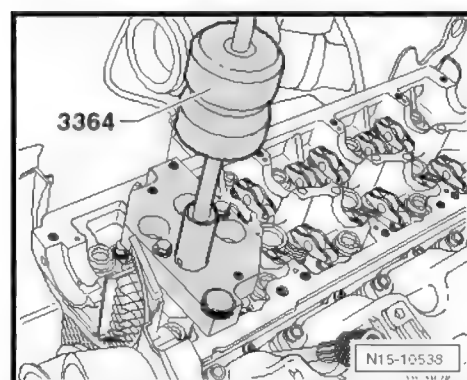
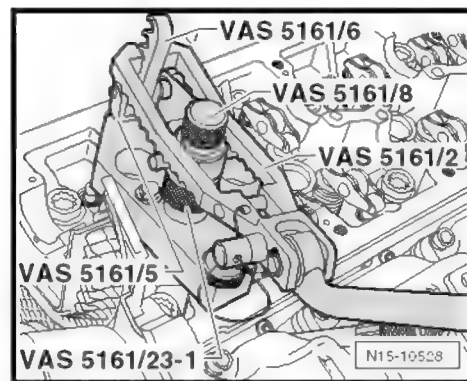


- Insert drift -VAS 5161/3- into guide plate and use plastic-headed hammer to release sticking valve cotters.





- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Slide sleeve -VAS 5161/23-1- onto assembly cartridge - VAS 5161/8- .
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take off assembly cartridge with knurled spacer ring.
- Detach valve spring with valve spring plate.
- Pull off valve stem oil seal with valve stem seal puller - 3364- .

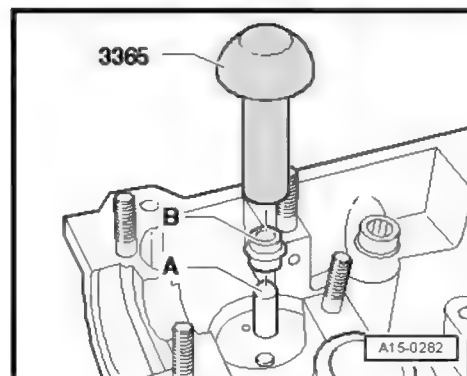


Caution

Make sure valve stem oil seals are not damaged when installing.

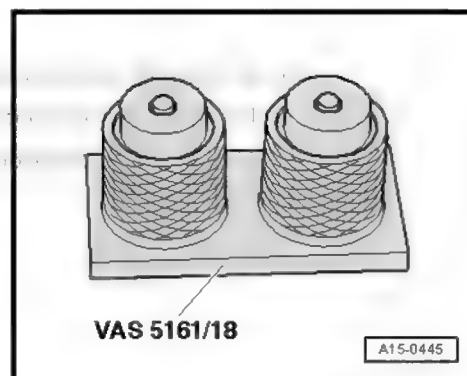
- ◆ *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*

- Lightly oil sealing lip of valve stem oil seal.
- Slide valve stem oil seal onto plastic sleeve.
- Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
- Take off plastic sleeve.



If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

- Larger diameter of valve cotters faces upwards.
- Insert valve spring and valve spring plate.
- Press assembly cartridge onto insertion device from above and take up valve cotters.



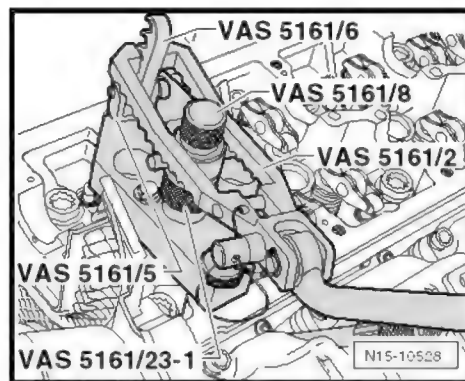


- Insert assembly cartridge in guide plate for 3.0 ltr. TDI engine - VAS 5161/23- again.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

Installation is carried out in the reverse order; note the following:

- Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
- Install camshafts ➔ [page 118](#) .



Warranty is void if the engine is used for commercial purposes. In particular, it is not permitted to use the engine for the purpose of generating electricity. The manufacturer is not responsible for any damage or information in this document. Copyright © 2019 Audi AG.



4 Inlet and exhaust valves

⇒ ["4.1 Machining valve seats", page 133](#)

⇒ ["4.2 Checking valve guides", page 133](#)

⇒ ["4.3 Checking valves", page 134](#)

⇒ ["4.4 Valve dimensions", page 134](#)

4.1 Machining valve seats



Note

Valve seats may not be machined due to the very small tolerances.

4.2 Checking valve guides

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-



Procedure

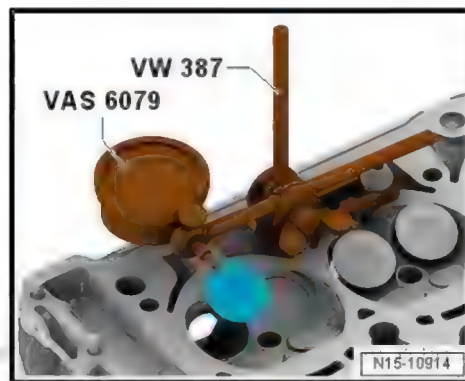


Note

- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.*



- Attach dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder head.
- Insert valve into guide.
- End of valve stem must be flush with guide.
- Measure the amount of sideways play.
- Wear limit: 1.0 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.



Note

Valve guides cannot be renewed.

4.3 Checking valves

- Visually inspect for scoring on valve stems and valve seat surfaces.
- Renew valve if scoring is clearly visible.

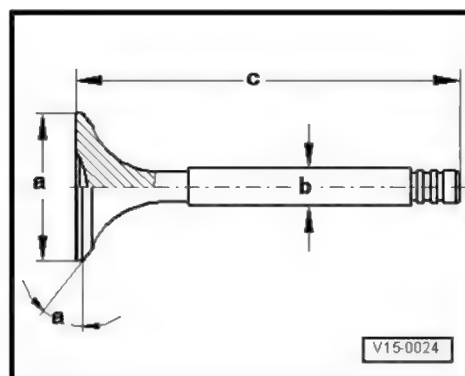
4.4 Valve dimensions



Note

Valves must not be machined. Only grinding-in is permitted.

Dimension		Inlet valve	Exhaust valve
Ø a	mm	28.10	26.00
Ø b	mm	5.975	5.965
c	mm	99.30	99.10
α	°	45	45





17 – Lubrication

1 Sump/oil pump

⇒ [“1.1 Exploded view - sump/oil pump”, page 135](#)

⇒ [“1.2 Engine oil”, page 139](#)

⇒ [“1.3 Removing and installing sump”, page 139](#)

⇒ [“1.4 Removing and installing oil pump”, page 142](#)

⇒ [“1.5 Removing and installing oil level and oil temperature sender G266”, page 143](#)

1.1 Exploded view - sump/oil pump



Note

- ◆ *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil passages carefully and renew the oil spray jets, engine oil cooler and oil filter.*
- ◆ *Oil spray jet and pressure relief valve ⇒ [page 75](#)*



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1 - Seal

- ☐ Renew

2 - Oil drain plug

- ☐ 30 Nm

3 - Sump

- ☐ Removing and installing
⇒ [page 139](#)

4 - Bolt

- ☐ 9 Nm

5 - Suction pipe

- ☐ Clean strainer if dirty

6 - O-ring

- ☐ Renew

7 - Oil pump

- ☐ Removing and installing
⇒ [page 142](#)

- ☐ Before installing, check that the two dowel sleeves for centring oil pump are fitted onto balance shaft assembly

8 - Drive shaft

- ☐ For oil pump

9 - Circlip

- ☐ Must fit securely in groove
- ☐ Renew circlip if damaged or stretched

10 - Spur gear

- ☐ For balance shaft

11 - Bolt

- ☐ Renew
- ☐ 20 Nm +90°

12 - Thrust washer

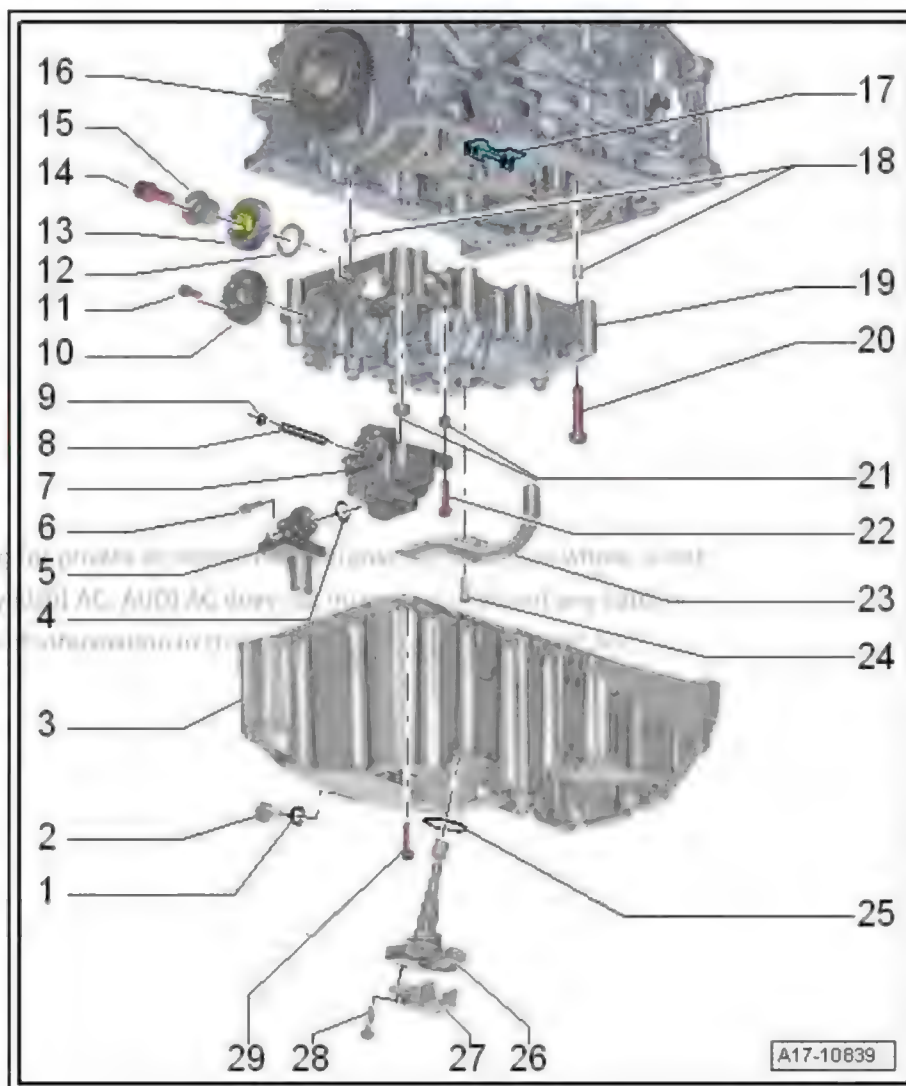
- ☐ For idler gear
- ☐ Renew
- ☐ Installation position ⇒ [page 138](#)
- ☐ When installing idler gear, apply grease to hold washer on balance shaft assembly

13 - Idler gear

- ☐ For balance shaft assembly
- ☐ If the bolt for the idler gear has been slackened or the spur gear on the crankshaft or the crankshaft itself have been renewed, you must install a new idler gear with the appropriate coating. Procedure for installation ⇒ ["4.1.2 Installing new balance shaft assembly", page 151](#)
- ☐ To achieve the correct backlash a suitably thick coating is already applied to the new idler gear; the required clearance is achieved as the coating is worn down
- ☐ Installation position: Part No. must be visible.
- ☐ Make sure thrust washer is properly seated ⇒ [page 138](#)

14 - Bolt

- ☐ With washer
- ☐ Renew





- ☐ If the bolt for the idler gear has been slackened or the spur gear on the crankshaft or the crankshaft itself have been renewed, you must install a new idler gear with the appropriate coating. Procedure for installation ⇒ ["4.1.2 Installing new balance shaft assembly", page 151](#)

- ☐ 90 Nm +90°

15 - Hub

- ☐ For idler gear
- ☐ Renew

16 - Crankshaft gear

17 - Cover

- ☐ Installation position for cover of oil level and oil temperature sender - G266- ⇒ [page 138](#)

18 - Dowel sleeves

19 - Balance shaft assembly

- ☐ Removing ⇒ [page 150](#)
- ☐ Before installing, check that the two dowel sleeves for centring balance shaft assembly are fitted on cylinder block
- ☐ Installing new balance shaft assembly ⇒ [page 151](#)
- ☐ Re-installing "old" balance shaft assembly ⇒ [page 155](#)

20 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 139](#)

21 - Dowel sleeves

22 - Bolt

- ☐ 9 Nm

23 - Oil intake pipe

24 - Bolt

- ☐ 9 Nm

25 - Seal

- ☐ Renew

26 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing ⇒ [page 143](#)

27 - Cover

- ☐ For oil level and oil temperature sender - G266-

28 - Bolt

- ☐ Self-locking
- ☐ Renew
- ☐ 9 Nm

29 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [page 138](#)

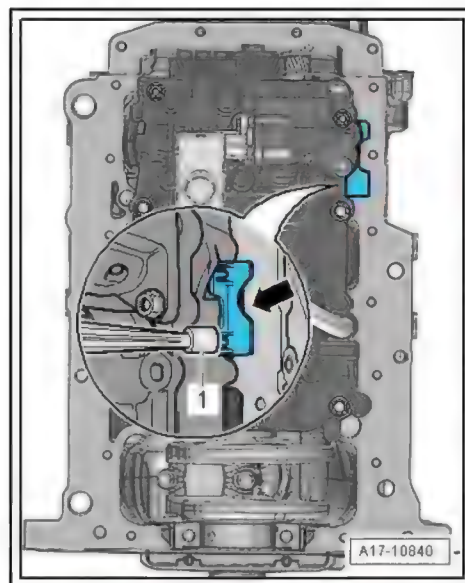
Installation position for cover of oil level and oil temperature sender

- Clip in cover for oil level and oil temperature sender -arrow-, as shown in illustration.



Note

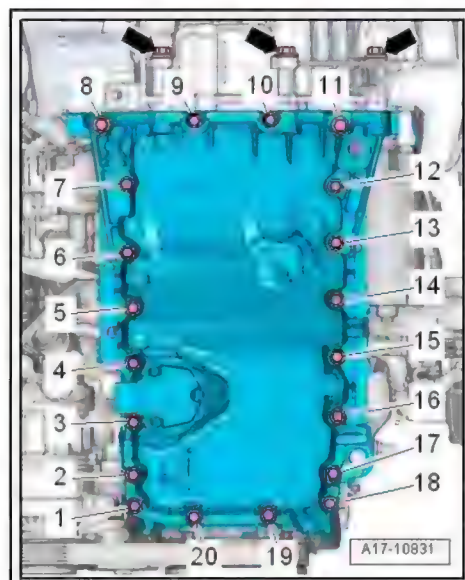
For greater clarity, item -1- shows oil level and oil temperature sender.



Sump - tightening torque and sequence

- Tighten bolts in stages:

Stage	Bolts	Tightening torque
1.	-1 ... 20-	5 Nm in diagonal sequence
2.	-Arrows-	⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox or ⇒ Rep. gr. 37 ; Removing and installing gearbox; Tightening torques for gearbox
3.	-1 ... 7-, -9, 10-, -12 ... 20-	Tighten in stages and in diagonal sequence; final torque 13 Nm
4.	-8, 11-	23 Nm



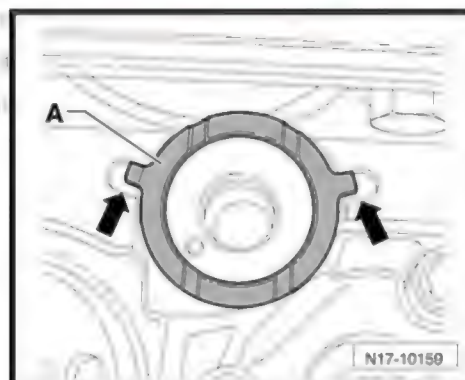
Installation position of thrust washer



Caution

Thrust washer can slip out of position behind idler gear.

- ♦ Make sure that thrust washer -A- does not slip out of the recesses in the balance shaft assembly -arrows- when fitting the idler gear. If this is neglected, the thrust washer can become trapped. If necessary, apply grease to hold washer on balance shaft assembly.



Balance shaft assembly - tightening torque and sequence

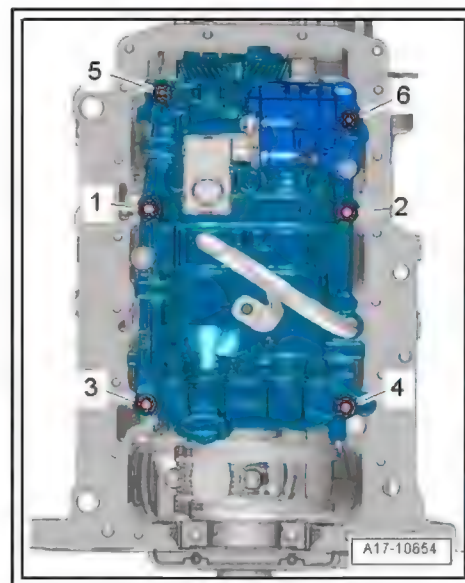


Note

Renew the bolts tightened with specified tightening angle.

– Tighten bolts in 5 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 ... 6-	Screw in by hand until contact is made
2.	-1 ... 6-	6 Nm
3.	-5- and -6-	13 Nm
4.	-1 ... 4-	20 Nm
5.	-1 ... 4-	Turn 90° further



1.2 Engine oil

Oil capacities, oil specifications and viscosity grades ⇒ Maintenance tables .

1.3 Removing and installing sump

Special tools and workshop equipment required

◆ Socket - T10058-



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Removing

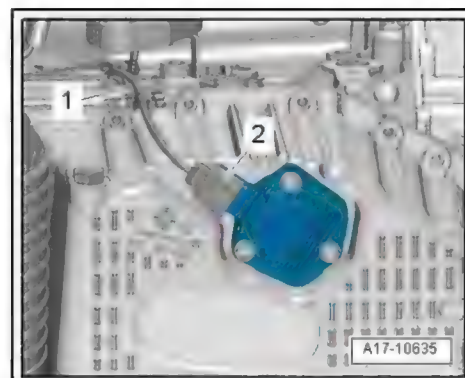
- Engine oil drained ⇒ Maintenance ; Booklet 411
- Remove subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Unplug electrical connector -2- at oil level and oil temperature sender - G266- .



Note

Disregard -item 1-.

- Remove torque reaction support ⇒ [page 38](#) .





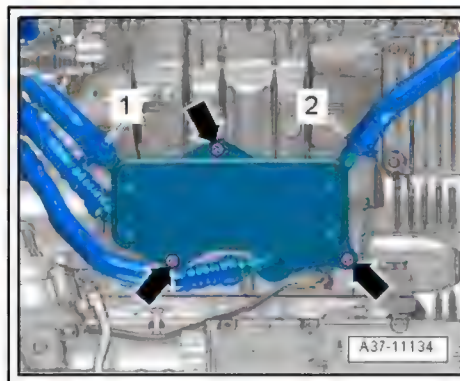
Vehicles with multitronic gearbox:

- Remove bolts -arrows- and push ATF cooler slightly to the side.



Note

Disregard items -1 and 2-.



- Remove bolts securing sump to gearbox -arrows-.
- Slacken bolts -1 ... 20- in diagonal sequence and remove.
- Carefully release oil sump from bonded joint and detach.

Installing

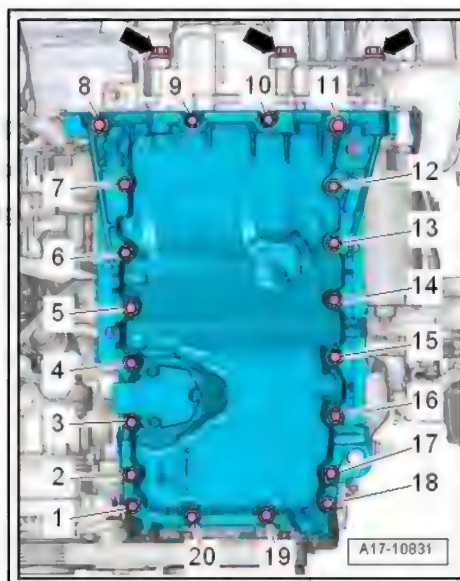


aspect to the current situation.

Caution

Protect lubrication system and bearings against contamination.

- ◆ Cover exposed parts of the engine.

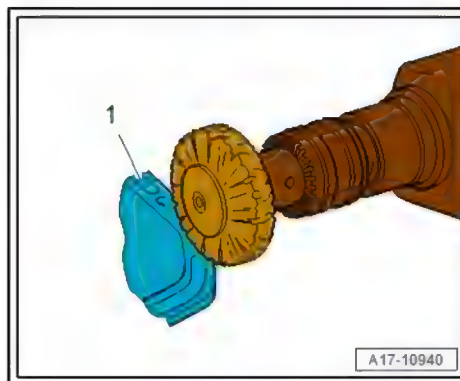


WARNING

Risk of eye injury.

- ◆ Put on safety goggles.

- Remove sealant residue from sump and cylinder block using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.



i Note

Note the use-by date of the sealant.

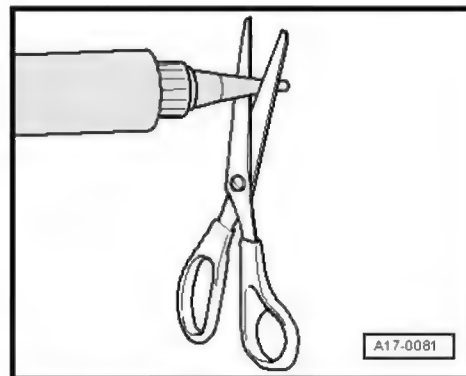
- Cut off nozzle of tube at front marking (nozzle Ø approx. 2 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

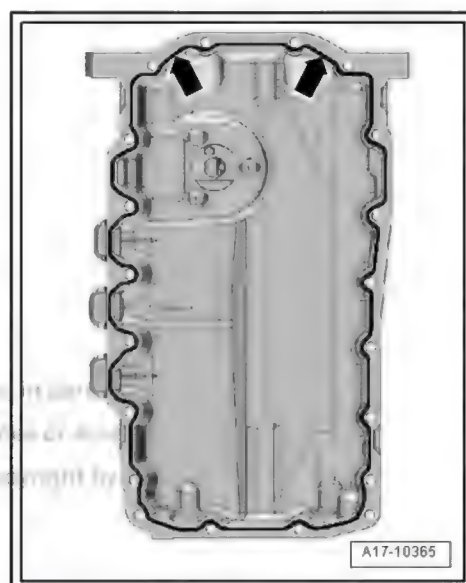
- ◆ *The sealant bead must not be thicker than specified.*



- Apply sealant bead onto clean sealing surface of sump as illustrated.
- Thickness of sealant bead: 2 ... 3 mm.

i Note

- ◆ *Take particular care when applying sealant bead in area of rear sealing flange -arrows-.*
- ◆ *The sump must be installed within 5 minutes after applying the sealant.*

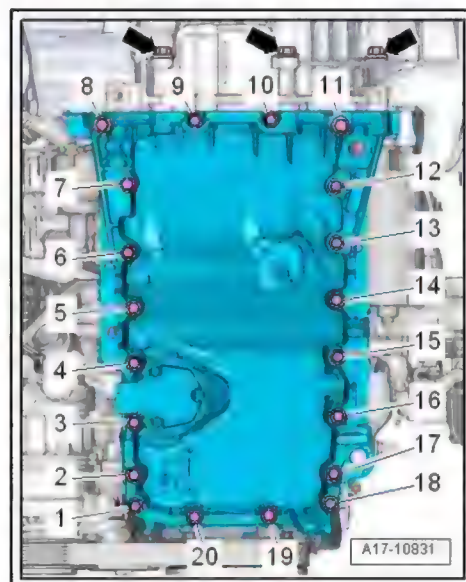


- Fit sump and tighten bolts ➔ [page 138](#) .

i Note

- ◆ *When installing sump with engine removed from vehicle, ensure that sump is positioned flush with cylinder block at fly-wheel end.*
- ◆ *After fitting sump, sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.*

- Install torque reaction support ➔ [page 38](#) .
- Install ATF cooler ➔ Rep. gr. 37 ; ATF circuit; Removing and installing ATF cooler .
- Install subframe ➔ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Fill with engine oil and check oil level ➔ Maintenance ; Booklet 411 .



Tightening torques

- ◆ ➔ [Fig. "Sump - tightening torque and sequence"](#) , [page 138](#)



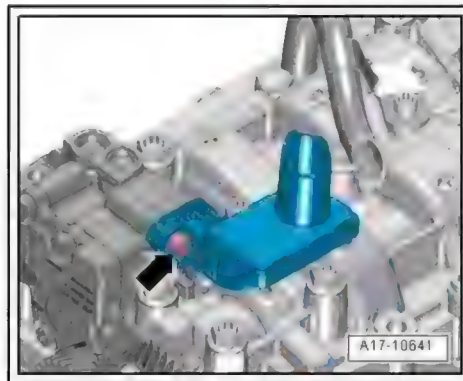
1.4 Removing and installing oil pump

Special tools and workshop equipment required

- ◆ Circlip pliers (commercially available)
- ◆ M3 bolt

Removing

- Remove sump ⇒ [page 139](#) .
- Remove bolt -arrow- and detach suction pipe from oil pump.

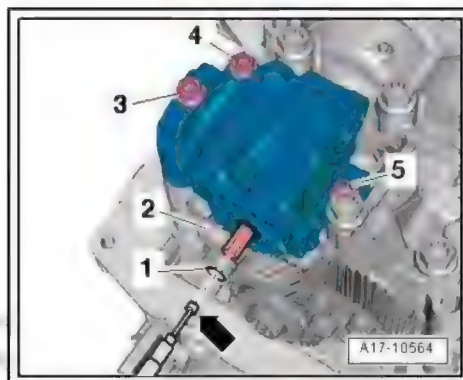


- Remove circlip -1- using circlip pliers.
- Pull drive shaft -2- out of oil pump using a magnet -arrow-.
- Remove bolts -3, 4, 5- and detach oil pump.



Caution

The bolt on the idler gear **must NOT** be loosened.



Installing

Installation is carried out in reverse order, note the following:

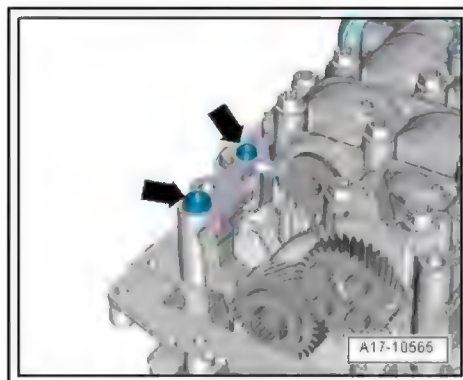


Note

- ◆ Fit new O-ring.
- ◆ Renew circlip if damaged or stretched.
- ◆ Circlip must fit securely in groove.
- Insert dowel sleeves -arrows- in oil pump, if not fitted.
- If no dowel sleeves for centring the oil pump are fitted in the balance shaft assembly, install missing dowel sleeves.
- Install sump ⇒ [page 139](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - sump/oil pump", page 135](#)





1.5 Removing and installing oil level and oil temperature sender - G266-

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 411
- Unplug electrical connector -3-.
- Remove bolts -1- and detach oil level and oil temperature sender - G266- -item 4-.

Installing

Installation is carried out in reverse order; note the following:



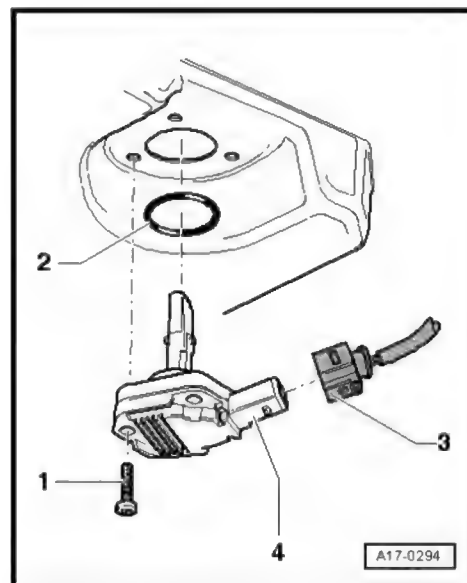
Note

Renew seal -2- and self-locking bolts -1-.

- Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 411 .

Tightening torques

- ♦ ⇒ [“1.1 Exploded view - sump/oil pump”, page 135](#)



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2 Engine oil cooler

⇒ ["2.1 Removing and installing engine oil cooler", page 144](#)

2.1 Removing and installing engine oil cooler

Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Drain coolant ⇒ [page 162](#) .



Note

Place a cloth underneath to catch escaping coolant and engine oil.

- On vehicles with multitronic gearbox: Release hose clip -1- and detach coolant hose.
- Unscrew bolts -arrows- and detach engine oil cooler.

Installing

Installation is carried out in reverse order; note the following:



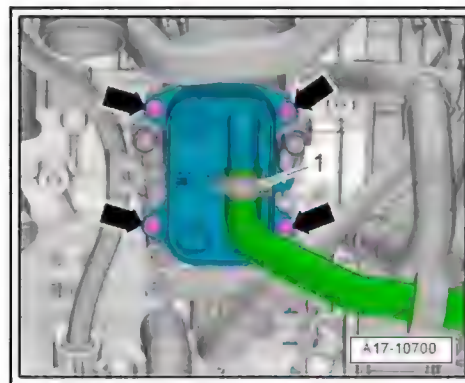
Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .
- Check oil level ⇒ Maintenance ; Booklet 411 .

Tightening torques

- ♦ ⇒ ["3.1 Exploded view - oil filter", page 145](#)





3 Oil filter/oil pressure switches

⇒ "3.1 Exploded view - oil filter", page 145

⇒ "3.2 Removing and installing oil pressure switch F1 ", page 146

⇒ "3.3 Removing and installing oil filter housing", page 146

⇒ "3.4 Checking oil pressure", page 149

3.1 Exploded view - oil filter

1 - Sealing cap

- ☐ 25 Nm

2 - O-ring

- ☐ Renew

3 - O-ring

- ☐ Renew

4 - O-ring

- ☐ Renew

5 - Oil filter element

- ☐ See note ⇒ [page 135](#)
- ☐ Removing and installing
⇒ Maintenance ; Book-
let 411

6 - Engine oil cooler

- ☐ See note ⇒ [page 135](#)
- ☐ Connection diagram -
coolant hoses
⇒ [page 157](#)
- ☐ Removing and installing
⇒ [page 144](#)
- ☐ If renewed, refill system
with fresh coolant

7 - Bolt

- ☐ 11 Nm

8 - Gaskets

- ☐ Renew

9 - Bolt

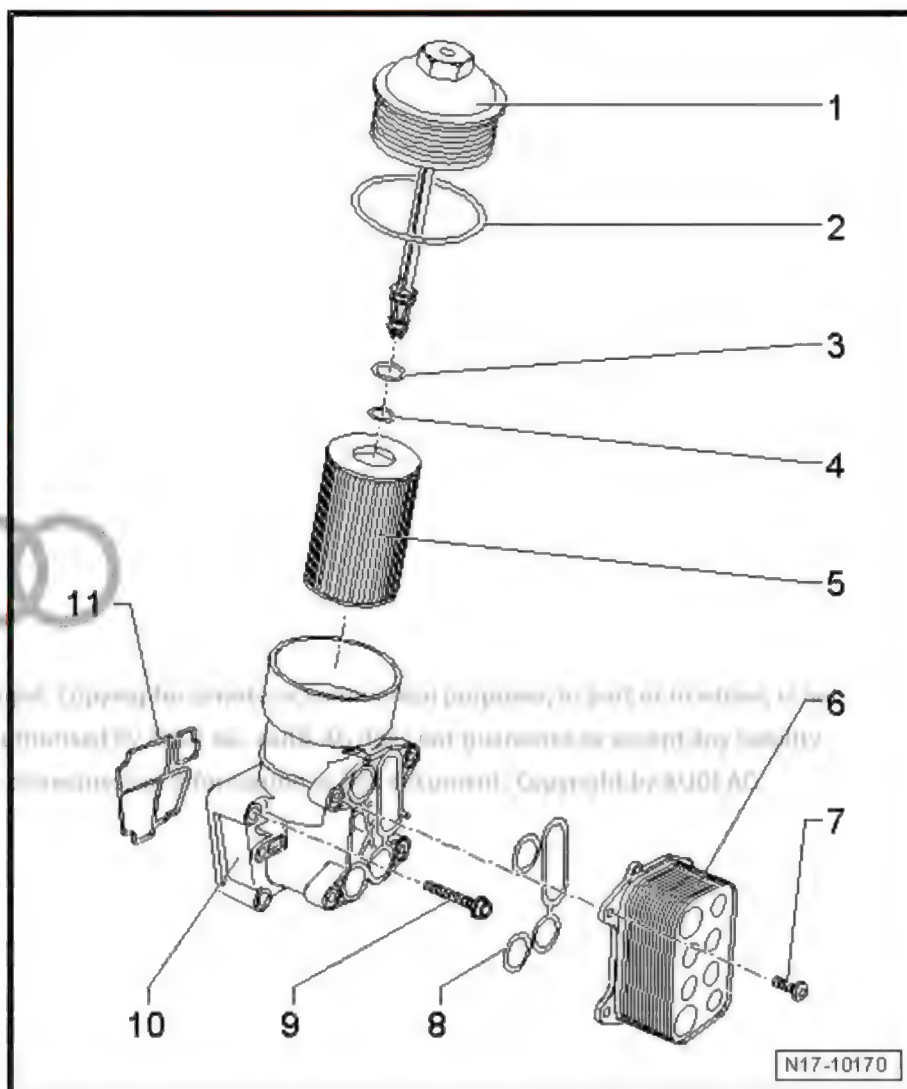
- ☐ Renew
- ☐ Tightening torque and
sequence ⇒ [page 146](#)

10 - Oil filter bracket

- ☐ With integrated oil retention valve
- ☐ Removing and installing ⇒ [page 146](#)

11 - Gaskets

- ☐ Renew



Oil filter bracket - tightening torque and sequence

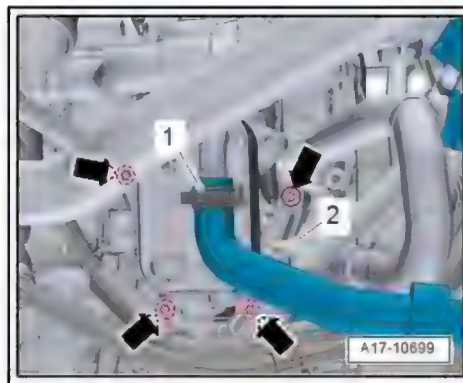


Note

Renew the bolts tightened with specified tightening angle.

- Fit bolts at top left and bottom right first.
- Tighten bolts in 2 stages:

Stage	Bolts	Tightening torque/angle specification
1.	-Arrows-	14 Nm in diagonal sequence
2.	-Arrows-	Turn 90° further in diagonal sequence



3.2 Removing and installing oil pressure switch - F1-

Special tools and workshop equipment required

- ♦ Articulated wrench, 24 mm - T40175-



Removing

- Remove air cleaner housing ⇒ [page 227](#) .
- Remove bolts -2- and -3- and detach engine lifting eye -1-.
- Unplug electrical connector -4-.
- Use articulated wrench, 24 mm - T40175- to unscrew oil pressure switch - F1-.

Installing

Installation is carried out in reverse order; note the following:

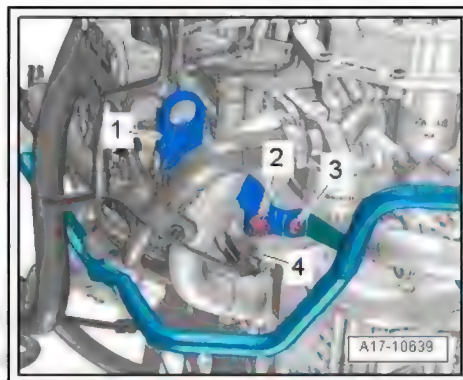
- Renew seal for oil pressure switch - F1- after removal.
- Cut seal open to renew.

If seal is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal

- Install coolant pipe (rear right) ⇒ [page 183](#) .
- Install air cleaner housing ⇒ [page 227](#) .
- Check oil level ⇒ Maintenance ; Booklet 411 .

Tightening torques

- ♦ ⇒ [“2.1 Exploded view - cylinder head”, page 93](#)



3.3 Removing and installing oil filter housing

Special tools and workshop equipment required



- ◆ Removal lever - 80 - 200-



- ◆ Drip tray for workshop hoist - VAS 6208-



- ◆ Hose clip pliers - VAS 6362-



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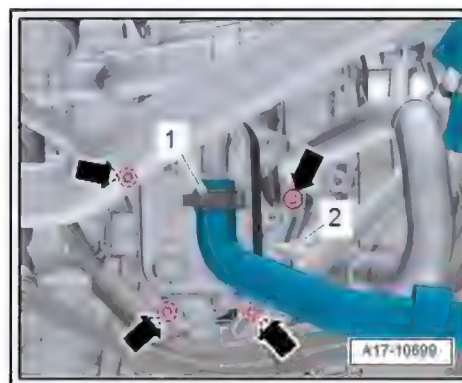
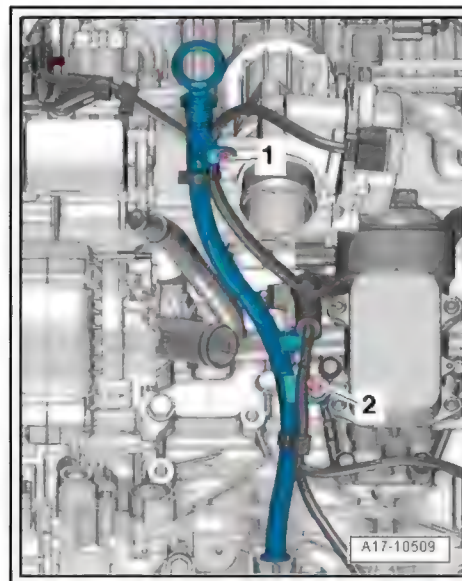


- ◆ Used oil collection and extraction unit - VAS 6622A-



Removing

- Drain coolant ➔ [page 162](#) .
 - Remove oil filter element ➔ Maintenance ; Booklet 411 .
 - Remove coolant pipe (top left) ➔ [page 181](#) .
 - Remove pump for exhaust gas recirculation cooler - V400- ➔ [page 170](#) .
 - Pull oil dipstick out slightly and remove bolt -1-.
 - Release clip -2- with removal lever - 80 - 200- .
 - Pull guide tube for oil dipstick upwards out of cylinder block and push to one side.
-
- Place drip tray for workshop hoist - VAS 6208- under connection.
 - Release hose clip -2- and detach coolant hose.
 - On vehicles with multitronic gearbox: Release hose clip -1- and detach coolant hose.
 - Position used oil collection and extraction unit - V.A.G 1782- below engine.
 - Unscrew bolts -arrows- and remove oil filter bracket with engine oil cooler.



Installing

Installation is carried out in reverse order; note the following:



Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew seal.*
- Install pump for exhaust gas recirculation cooler - V400- ➔ [page 170](#) .
- Install coolant pipe (top left) ➔ [page 181](#) .
- Install oil filter element, fill up with engine oil and check oil level ➔ Maintenance ; Booklet 411 .



Note

Do not reuse coolant.

- Fill up with coolant ➔ [page 164](#) .

Tightening torques

- ◆ ➔ [Fig. "Oil filter bracket - tightening torque and sequence", page 146](#)
- ◆ Dipstick guide tube
➔ ["1.1 Exploded view - sump/oil pump", page 135](#)

Special tools and workshop equipment required

- V.A.G 1342**
- 
- The image shows a V.A.G 1342 diagnostic tool, which is a circular, orange-colored device with a central port. It is connected to a long, flexible, orange-colored hose that loops around. A white cable with two connectors is also attached to the tool.
- W00-11173

- Oil level OK
- Remove oil pressure switch - F1- ⇒ page 146 .
- Connect oil pressure tester - V.A.G 1342- to bore for oil pressure switch.
- Screw a used oil pressure switch into threaded hole on oil pressure tester - V.A.G 1342- to seal hole.
- Start engine.
- Oil pressure when starting and then at idling speed: at least 0,6 bar.

If specification is obtained, let engine warm up.

- ## Assembling

- Install oil pressure switch - F1- ⇒ **page 146** .



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4 Balance shaft assembly

⇒ "4.1 Removing and installing balance shaft assembly",
page 150

4.1 Removing and installing balance shaft assembly

⇒ "4.1.1 Removing balance shaft assembly", page 150

⇒ "4.1.2 Installing new balance shaft assembly", page 151

⇒ "4.1.3 Installing used balance shaft assembly", page 155

4.1.1 Removing balance shaft assembly

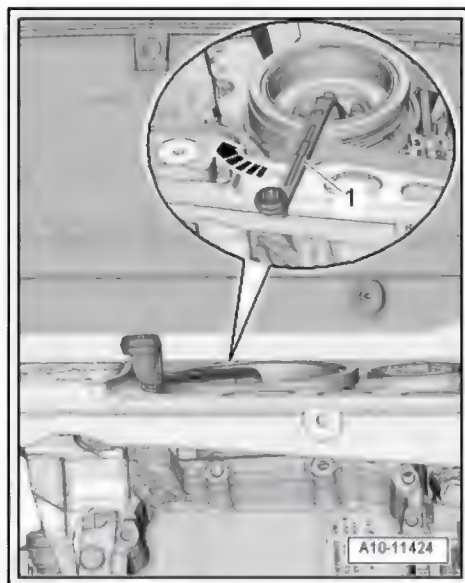
Special tools and workshop equipment required

- ◆ Diesel injection pump locking pin - 3359-



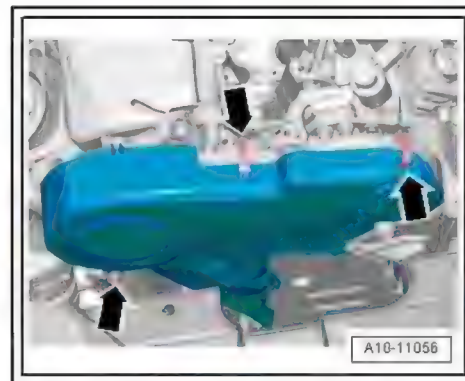
Procedure

- Pull out oil dipstick.
- Remove sump ⇒ [page 139](#) .
- Detach cap from vibration damper.
- Using angled ring spanner -1- at vibration damper, turn crankshaft in normal direction of rotation -arrow- until crankshaft is at "TDC".



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- Release retaining clips -arrows- and detach toothed belt cover (top).

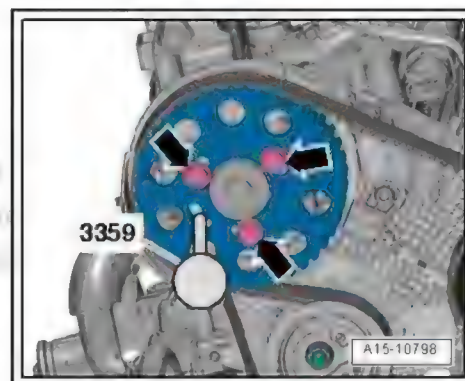


Caution

Irreparable damage can be caused if the toothed belt slips.

- ♦ *Only turn crankshaft in direction of engine rotation.*

- Lock camshaft hub with diesel injection pump locking pin - 3359- .



Note

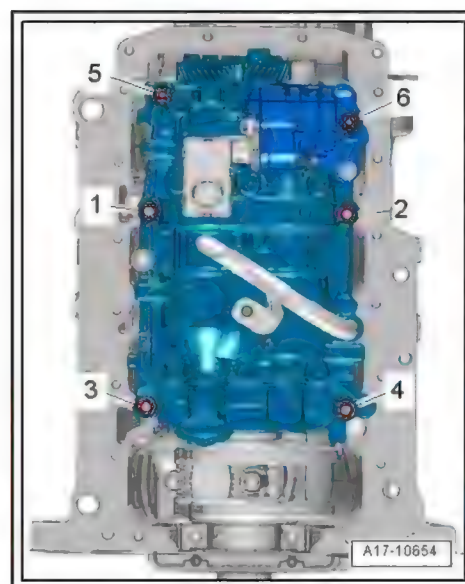
Disregard -arrows-.

- Loosen bolts in the sequence -6 ... 1-.
- Remove bolts and detach balance shaft assembly with oil pump.



Note

- ♦ *Installing a new balance shaft assembly ➔ [page 151](#) .*
- ♦ *Re-installing a used balance shaft assembly ➔ [page 155](#) .*



4.1.2 Installing new balance shaft assembly

Special tools and workshop equipment required



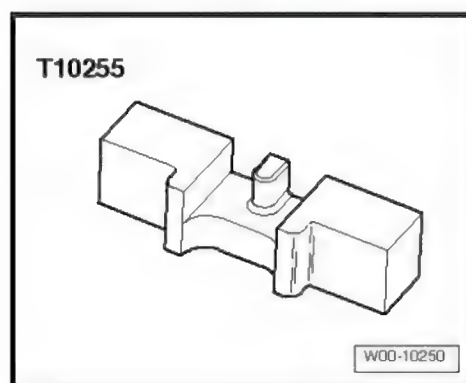
◆ Bits - T10099-



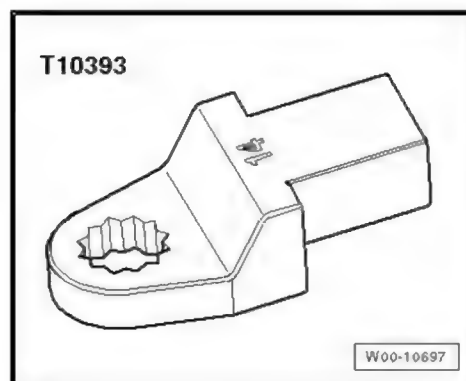
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◆ Locking tool - T10255-



◆ Open end spanner insert, AF 14 - T10393-



Procedure

- Camshaft locked with diesel injection pump locking pin - 3359- .



Note

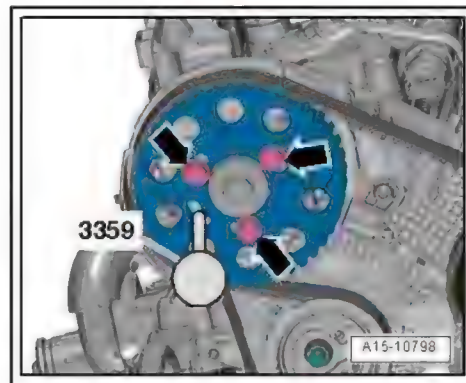
- ◆ *The spur gear drive of the balance shaft assembly must be installed with a specified backlash.*
- ◆ *To achieve the correct backlash, a coating is already applied to the new idler gear.*
- ◆ *The coating is worn down rapidly and the backlash is then correct.*
- ◆ *Therefore, a new balance shaft assembly must always be installed in conjunction with a new idler gear which has the correct coating.*
- ◆ *Renew the bolts tightened with specified tightening angle.*



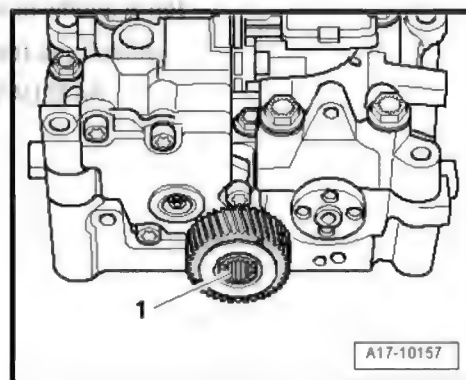
Caution

Thrust washer can slip out of position behind idler gear.

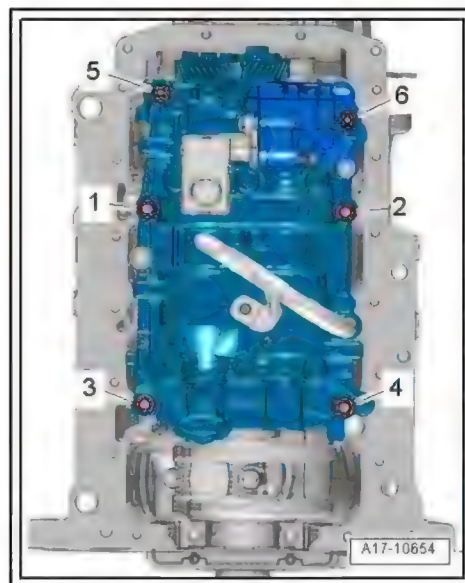
- ◆ *Before positioning balance shaft assembly, slacken off bolt for idler gear as specified below, but not further. Installation position of thrust washer ➔ [page 138](#)*



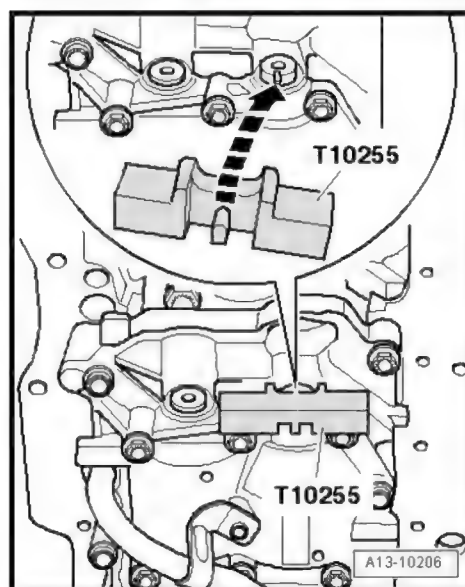
- Loosen bolt -1- for idler gear approx. 45° using e.g. bits - T10099- and insert tool, 14 mm A-T10393-.
- If not already fitted, fit dowel sleeves into cylinder block for centring balance shaft assembly.
- Attach balance shaft assembly to cylinder block.
- Take care not to damage the coating of the idler gear.



- Tighten bolts securing balance shaft assembly ➔ [page 139](#) .



- Lock balance shaft with locking tool - T10255- , turning balance shaft as required.
- The lug of the locking tool must engage in the groove of the balance shaft.

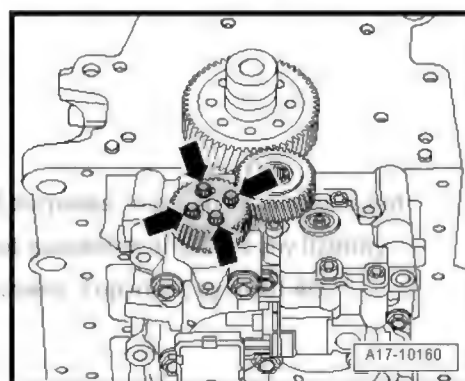


- Carefully fit balance shaft gear onto balance shaft; to do so, push idler gear slightly to one side.
- Take care not to damage the coating of the idler gear.
- The threaded holes in the balance shaft should be aligned as centrally as possible with the elongated holes in the balance shaft gear.



Note

If it is not possible to align the elongated holes in the balance shaft gear with the threaded holes, you must turn the gear some teeth further as required and then fit it again.

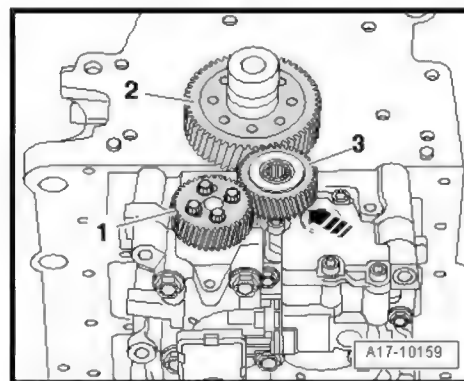


- Tighten bolts -arrows- for balance shaft gear.
- Remove locking tool - T10255- .

i Note

The following three steps have to be performed simultaneously (a second mechanic is therefore required):

- Push idler gear -3- firmly in direction of -arrow- into teeth on spur gear -2- and balance shaft gear -1-. If necessary use a wooden rod to do so.
- At the same time, turn balance shaft gear slightly anti-clockwise.
- Tighten bolt securing idler gear.
- Remove diesel injection pump locking pin - 3359- .



i Note

After installation the idler gear must have no backlash. This can be checked by exerting light pressure by hand.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install sump ➔ [page 139](#) .

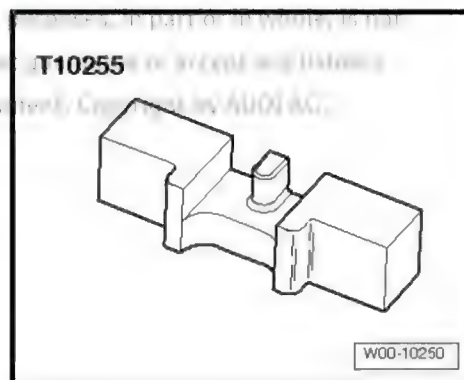
Tightening torques

- ◆ ➔ ["1.1 Exploded view - sump/oil pump", page 135](#)

4.1.3 Installing used balance shaft assembly

Special tools and workshop equipment required

- ◆ Locking tool **T10255**



Procedure

- Camshaft locked with diesel injection pump locking pin - 3359- .



Note

- ◆ If re-installing the "old" balance shaft assembly and neither the spur gear on the crankshaft nor the crankshaft itself have been renewed, proceed as described in the following. It is also essential that the idler gear has NOT been slackened.
- ◆ If the bolt for the idler gear has been slackened or the spur gear on the crankshaft or the crankshaft itself have been renewed, you must install a new idler gear with the appropriate coating. Procedure for installation
⇒ ["4.1.2 Installing new balance shaft assembly", page 151](#) .
- ◆ Renew the bolts tightened with specified tightening angle.

- Lock balance shaft with locking tool - T10255- , turning balance shaft as required.
- The lug of the locking tool must engage in the groove of the balance shaft.
- If not already fitted, fit dowel sleeves into cylinder block for centring balance shaft assembly.
- Attach balance shaft assembly to cylinder block.
- With the balance shaft locked in position, the idler gear must engage in the spur gear on the crankshaft.
- Idler gear must have noticeable backlash.

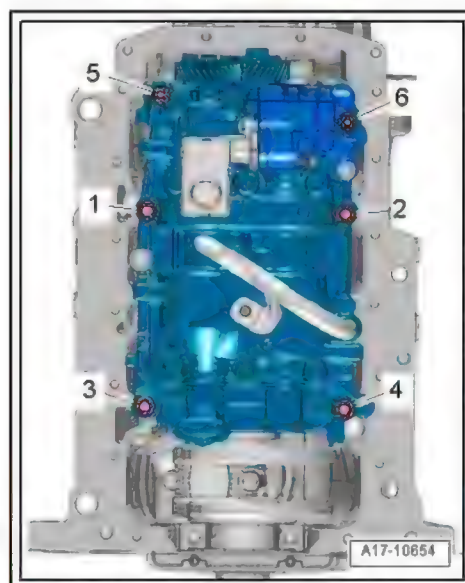
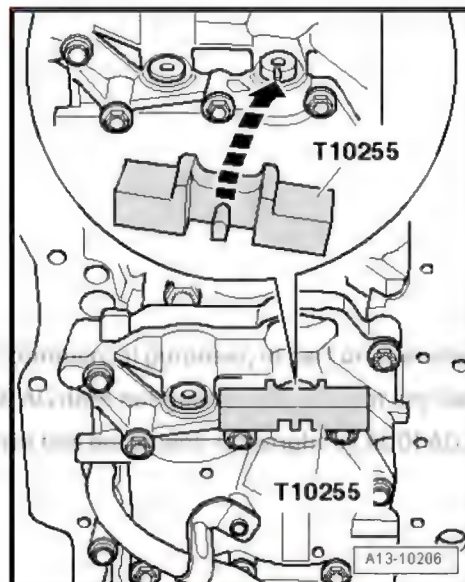
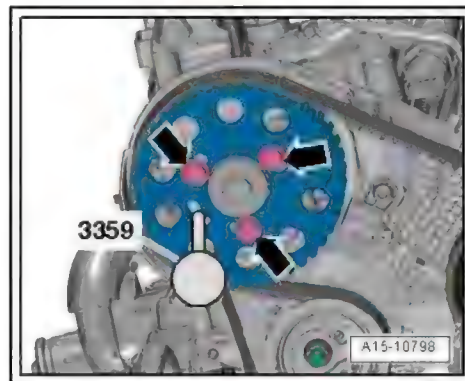
- Tighten bolts securing balance shaft assembly ⇒ [page 139](#) .
- Remove diesel injection pump locking pin - 3359- .

Remaining installation steps are carried out in reverse sequence; note the following:

- Install sump ⇒ [page 139](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - sump/oil pump", page 135](#)





19 – Cooling

1 Cooling system/coolant

⇒ [“1.1 Connection diagram - coolant hoses”, page 157](#)

⇒ [“1.2 Checking cooling system for leaks”, page 160](#)

⇒ [“1.3 Draining and filling cooling system”, page 162](#)

1.1 Connection diagram - coolant hoses

⇒ [“1.1.1 Connection diagram - coolant hoses, vehicles with manual gearbox and without auxiliary heater”, page 157](#)

⇒ [“1.1.2 Connection diagram - coolant hoses, vehicles with auxiliary heater and multitronic gearbox”, page 159](#)

1.1.1 Connection diagram - coolant hoses, vehicles with manual gearbox and without auxiliary heater



Note

- ◆ *Blue = Large coolant circuit*
- ◆ *Red = Small coolant circuit*
- ◆ *Brown = Heating circuit*
- ◆ *Orange = Coolant circuit for exhaust gas recirculation.*

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1 - Not fitted

2 - Radiator

- ☐ If renewed, refill system with fresh coolant

3 - Coolant pump

4 - Cylinder head/cylinder block

- ☐ If renewed, refill system with fresh coolant

5 - Exhaust gas recirculation cooler

- ☐ If renewed, refill system with fresh coolant

6 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing ⇒ [page 177](#)

7 - Coolant temperature sender - G62-

- ☐ Removing and installing ⇒ [page 176](#)

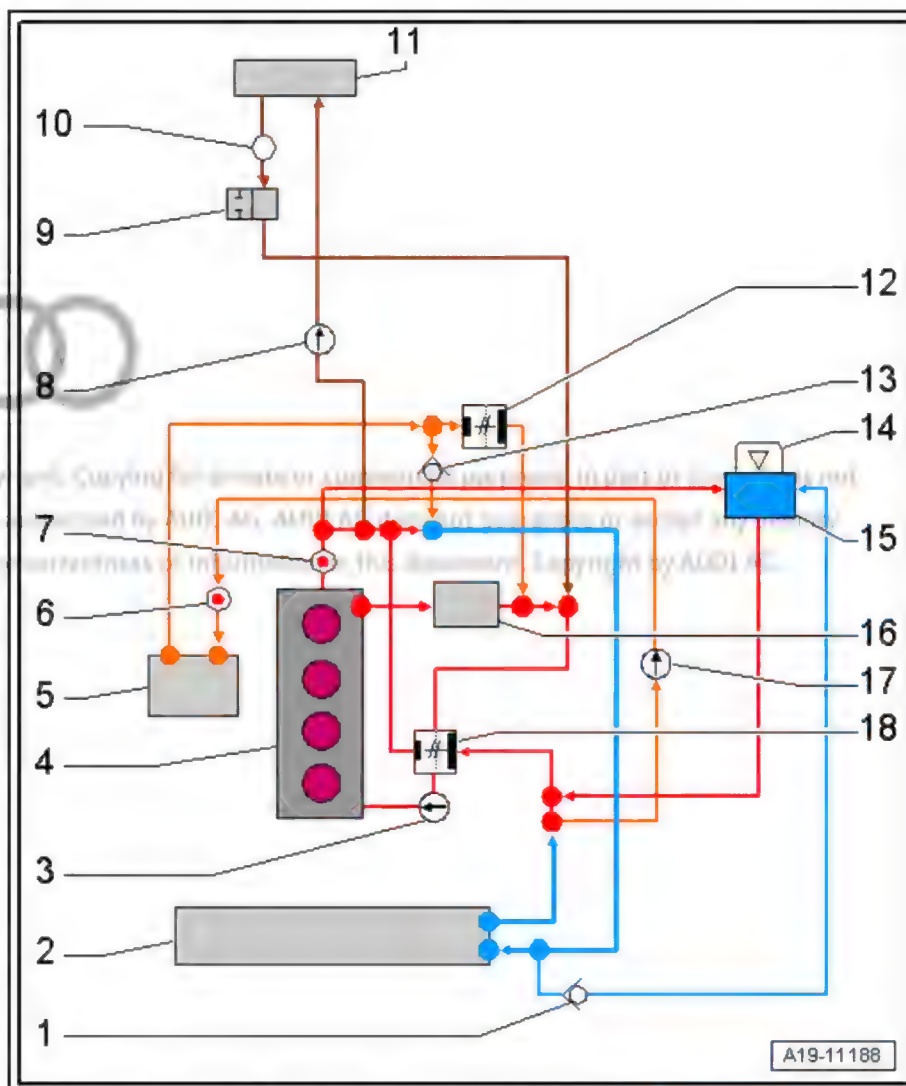
8 - Coolant circulation pump - V50-

- ☐ On vehicles with start/stop system only

9 - Coolant shut-off valve

- ☐ Depending on vehicle version, different coolant shut-off valves are installed.

- ☐ For a detailed description, refer to ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit; Overview of fitting locations - coolant circuit



10 - Bleeder hole

11 - Heat exchanger for heater

- ☐ If renewed, refill system with fresh coolant

12 - Thermostat

- ☐ For exhaust gas recirculation cooler

13 - Non-return valve

- ☐ Arrow points in direction of through-flow

14 - Filler cap

- ☐ For coolant expansion tank
- ☐ Checking ⇒ [page 160](#)

15 - Coolant expansion tank

- ☐ Checking cooling system for leaks ⇒ [page 160](#)

16 - Engine oil cooler

- ☐ If renewed, refill system with fresh coolant

17 - Pump for exhaust gas recirculation cooler - V400-

18 - 4/2-way valve with thermostat

1.1.2 Connection diagram - coolant hoses, vehicles with auxiliary heater and multitronic gearbox



Note

- ◆ Blue = Large coolant circuit
- ◆ Red = Small coolant circuit
- ◆ Brown = Heating circuit
- ◆ Orange = Coolant circuit for exhaust gas recirculation.
- ◆ Green = Coolant circuit for automatic gearbox.

1 - Radiator

- ☐ If renewed, refill system with fresh coolant

2 - Coolant pump

3 - Cylinder head/cylinder block

- ☐ If renewed, refill system with fresh coolant

4 - Exhaust gas recirculation cooler

- ☐ If renewed, refill system with fresh coolant

5 - Radiator outlet coolant temperature sender - G83-

- ☐ Removing and installing ⇒ [page 177](#)

6 - Coolant temperature sender - G62-

- ☐ Removing and installing ⇒ [page 176](#)

7 - Auxiliary heater

8 - Bleeder hole

9 - Heat exchanger for heater

- ☐ If renewed, refill system with fresh coolant

10 - Heater coolant shut-off valve - N279-

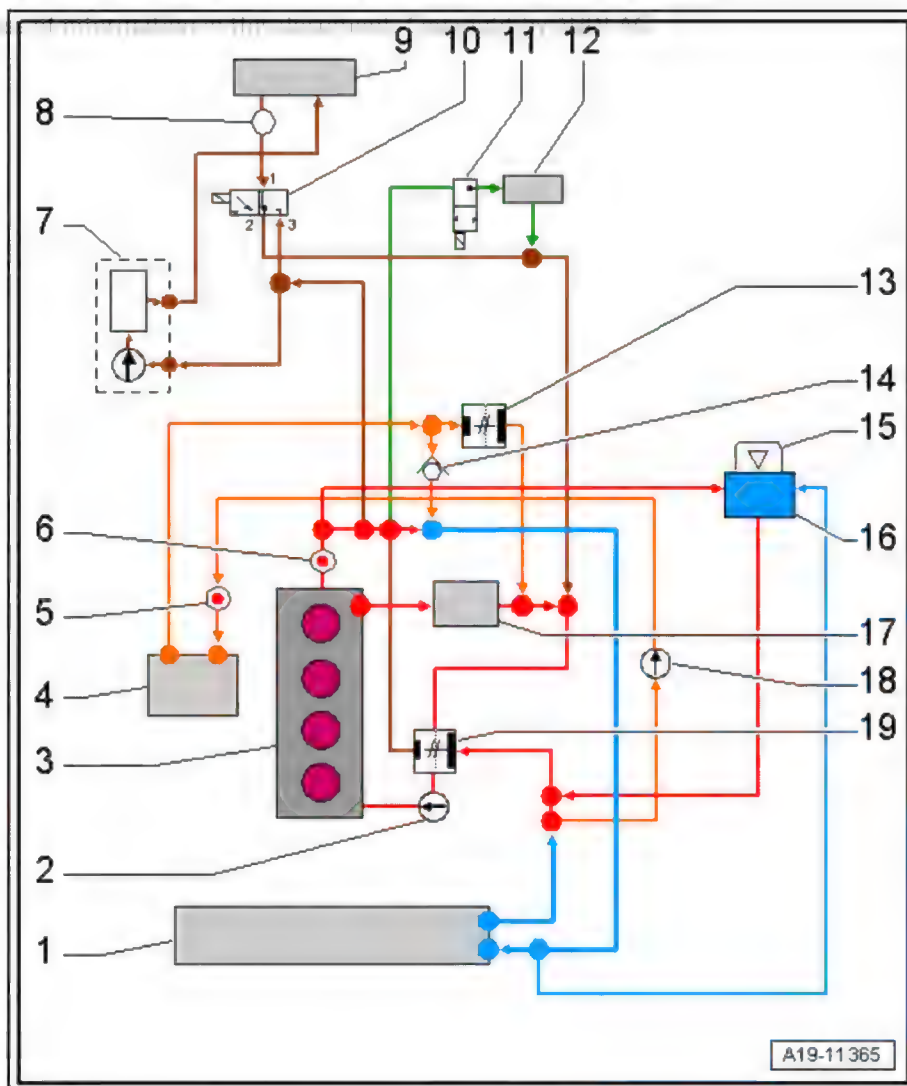
- ☐ Connection diagram, removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit; Overview of fitting locations - coolant circuit

11 - Gearbox oil cooling valve - N509-

- ☐ Only for vehicles with multitronic

12 - Auxiliary ATF cooler

- ☐ Only for vehicles with multitronic
- ☐ If renewed, refill system with fresh coolant





13 - Thermostat

- ☐ For exhaust gas recirculation cooler

14 - Non-return valve

- ☐ Arrow points in direction of through-flow

15 - Filler cap

- ☐ For coolant expansion tank
- ☐ Checking ⇒ [page 160](#)

16 - Coolant expansion tank

- ☐ Checking cooling system for leaks ⇒ [page 160](#)

17 - Engine oil cooler

- ☐ If renewed, refill system with fresh coolant

18 - Pump for exhaust gas recirculation cooler - V400-

19 - 4/2-way valve with thermostat

1.2 Checking cooling system for leaks

Special tools and workshop equipment required

- ♦ Cooling system tester - V.A.G 1274 B-



- ♦ Adapter for cooling system tester - V.A.G 1274/8-



- ◆ Adapter for cooling system tester - V.A.G 1274/9-



Checking cooling system for leaks

- Engine must be warm.
- Ignition switched off.

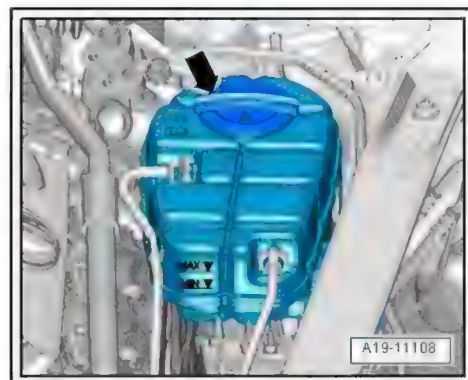


WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The cooling system is under pressure when the power unit is hot.*
- ◆ *Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.*

- Open filler cap -arrow- on coolant expansion tank.

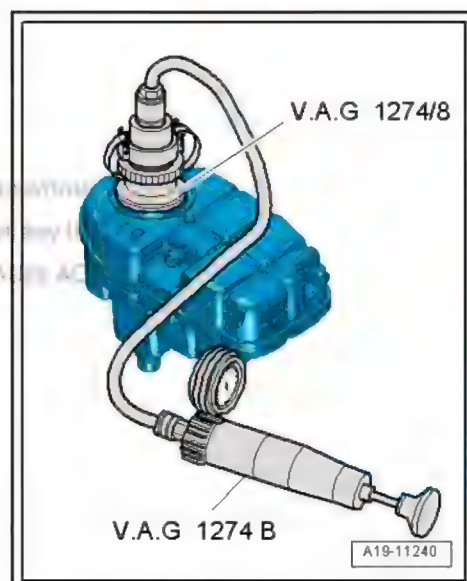


- Fit cooling system tester - V.A.G 1274 B- with adapter -V.A.G 1274/8- onto coolant expansion tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.5 bar.
- The pressure should not drop more than 0.2 bar within 10 minutes.
- If the pressure drops more than 0.2 bar, locate leak and eliminate fault.



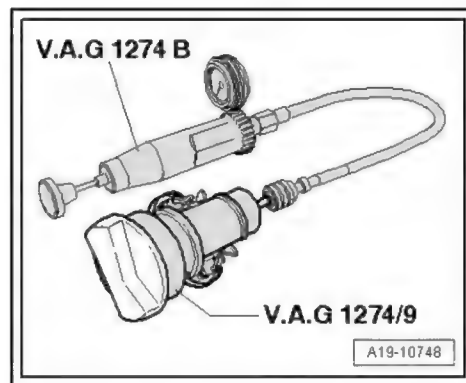
Note

The drop in pressure of 0.2 bar within 10 minutes is caused by the decrease in coolant temperature. The colder the engine is, the less the pressure will fall. If necessary, check again when the engine is cold.



Checking pressure relief valve in filler cap

- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.
- The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.
- Renew filler cap if pressure relief valve does not open as described.



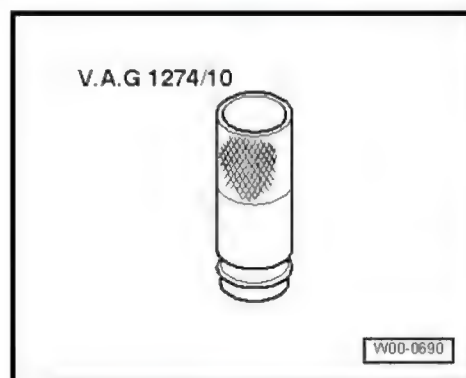
1.3 Draining and filling cooling system

Special tools and workshop equipment required

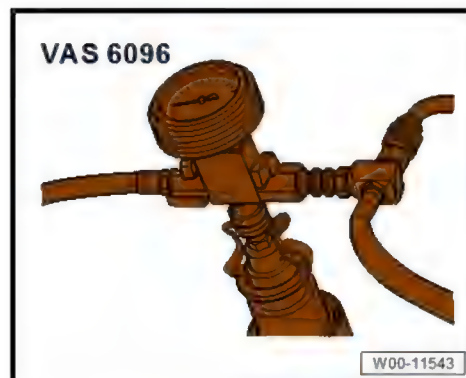
- ◆ Adapter for cooling system tester - V.A.G 1274/8-



- ◆ Pipe for cooling system tester - V.A.G 1274/10-



- ◆ Cooling system charge unit - VAS 6096-



◆ Refractometer - T10007A-



◆ Coolant collecting system - VAS 5014- or drip tray for workshop hoist - VAS 6208-



◆ Hose clip pliers - VAS 6362-



- ◆ Safety goggles
- ◆ Protective gloves

Draining



WARNING

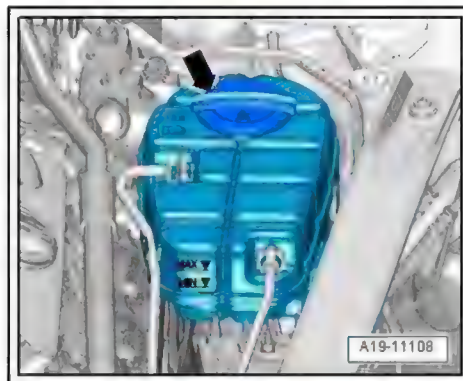
Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the power unit is hot.

Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.



- Open filler cap -arrow- on coolant expansion tank.

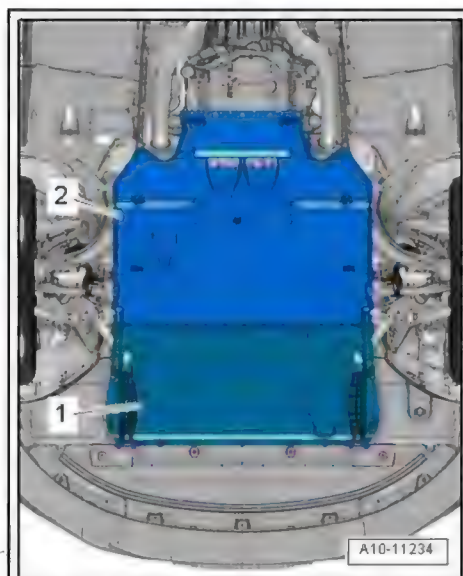


- Remove front noise insulation -1- ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

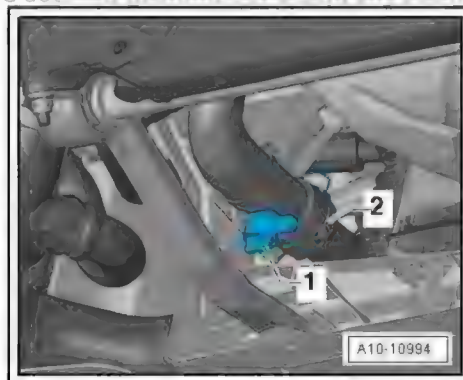


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- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Remove drain plug -1- at connection and drain off coolant.



Vehicles with multitronic gearbox:

- Release hose clip -arrow-, disconnect coolant hose and drain off coolant.

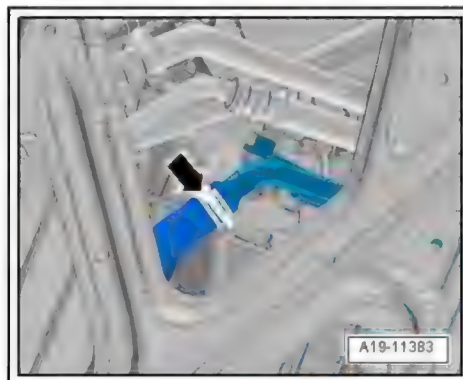
Filling

- Ignition switched off.



Caution

To ensure optimal corrosion protection, only distilled water may be mixed with coolant additives.



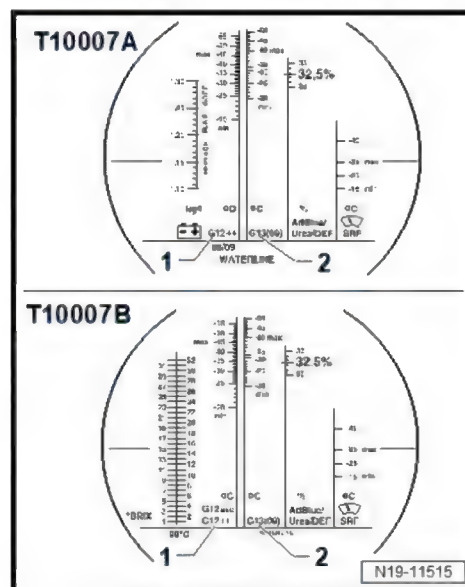


Note

- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
- ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . If you use other coolant additives, this can significantly impair in particular the corrosion protection effect. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ◆ *Coolant with the recommended mixture ratio prevents frost and corrosion damage and stops scaling. At the same time it raises the boiling point of the fluid in the system. For this reason the cooling system must be filled all year round with the correct coolant additive.*
- ◆ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ◆ *Refractometer - T10007A- or refractometer - T10007B- MUST be used to determine the current level of frost protection.*
- ◆ *Scale -1- on the refractometer applies to coolant additives G12 ++ and G12evo.*
- ◆ *Scale -2- on the refractometer applies to coolant additive G13.*
- ◆ *If more than one type of coolant additive has been used: Always use the scale for G13 to determine the anti-freeze protection.*
- ◆ *The mixture must guarantee frost protection down to at least -25 °C (in countries with arctic climate: down to -36 °C). The amount of antifreeze should only be increased if greater frost protection is required in very cold climates. This must only be down to -48 °C, however, as otherwise the cooling efficiency of the coolant is impaired.*
- ◆ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. Frost protection must be provided to at least -25 °C.*
- ◆ *The temperature indicated on the refractometer corresponds to the temperature at which the first ice crystals can form in the coolant.*
- ◆ *Do not reuse coolant.*
- ◆ *Only use water/coolant additive as a lubricant for coolant hoses.*

Recommended mixture ratio for coolant

- Coolant (40 %) and water (60 %) for frost protection to -25 °C
- Coolant (50 %) and water (50 %) for frost protection to -35 °C
- Coolant additive ⇒ Electronic parts catalogue



Procedure

- Close drain plug -1-.



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Vehicles with multitronic gearbox:

- Connect coolant hose using hose clip -arrow-.

All vehicles (continued):

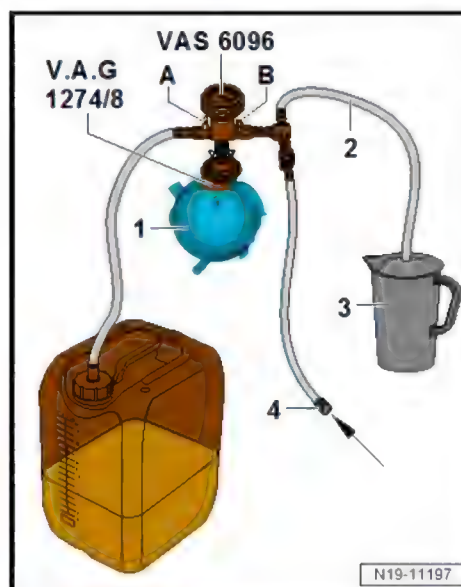
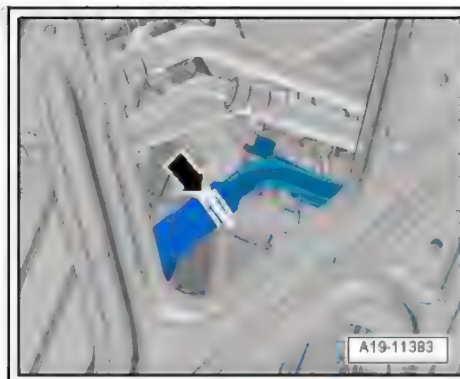
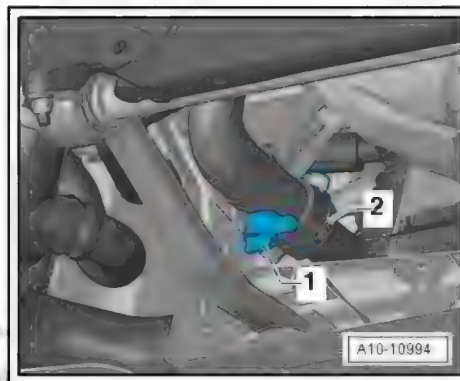
- Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio):
- Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
- Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
- Run vent hose -2- into a small container -3-.



Note

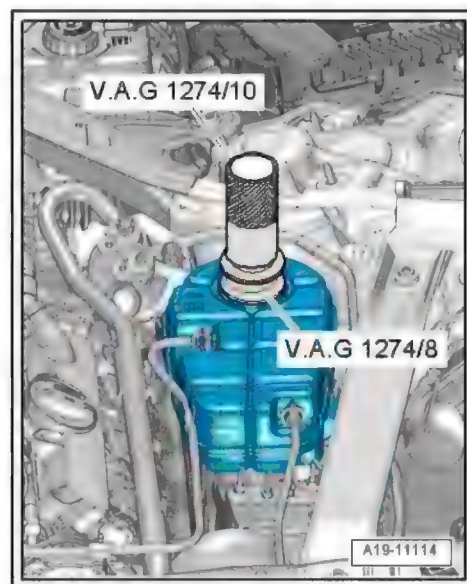
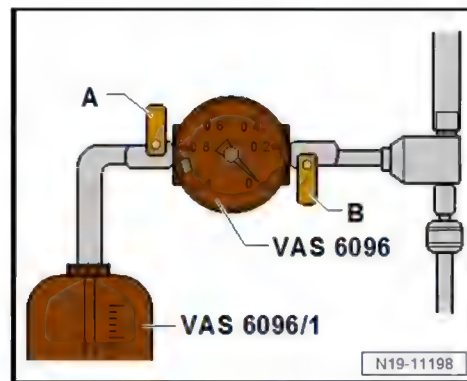
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -4- to compressed air supply.
- Pressure: 7 ... 10 bar.





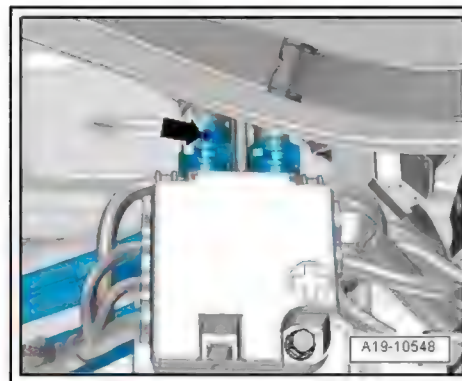
- Open valve -B- by setting lever in direction of flow.
- The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.
- If the needle does not reach the green zone, repeat the process.
- Check cooling system for leaks if the vacuum is not maintained.
- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from adapter -V.A.G 1274/8- on coolant expansion tank.
- Fit pipe for cooling system tester - V.A.G 1274/10- onto adapter for cooling system tester - V.A.G 1274/8- .
- Fill up pipe for cooling system tester - V.A.G 1274/10- with coolant.
- Remove plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber cover .



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- Release coolant hose going to heat exchanger for heater and pull back hose until bleeder hole -arrow- in hose is no longer blocked by connection.
- Fill up with coolant until it comes out at bleeder hole in coolant hose.
- Push coolant hose back onto connection and secure with spring-type hose clip.
- Detach pipe for cooling system tester - V.A.G 1274/10- and close filler cap on coolant expansion tank.
- Start engine.
- Set temperature to "HI" in all zones.



Time period	Engine speed	Air conditioner/heater setting
3 minutes	2000 rpm	<ul style="list-style-type: none">• Air conditioning system "OFF", LED in AC button not lit• Heating at "HI", select lowest possible blower speed (= 0)
Until both large coolant hoses at radiator become warm	Idling	<ul style="list-style-type: none">• Air conditioning system "OFF"• Heating at "HI"
1 minute	2000 rpm	<ul style="list-style-type: none">• Air conditioning system "OFF"• Heating at "HI"

- Switch off ignition and allow engine to cool down.
- Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

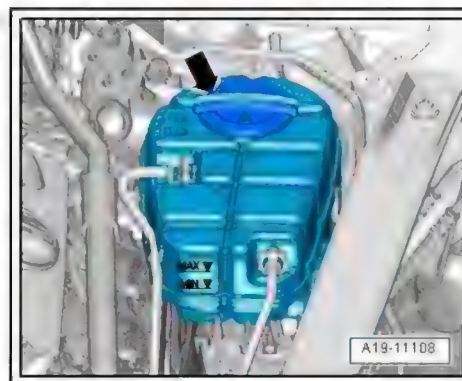
**WARNING**

Risk of scalding due to hot steam and hot coolant.

The cooling system is under pressure when the power unit is hot.

Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.

- Check coolant level.
- The coolant level must be at the "MAX" marking when the engine is cold.
- The coolant level can be above the "MAX" marking when the engine is warm.
- Top up with coolant again if necessary.
- Fill up coolant to approx. 5 mm above max. marking when engine is cold.
- Install engine cover panel.
- Erase event memory ⇒ Vehicle diagnostic tester.





2 Coolant pump/thermostat assembly

⇒ ["2.1 Exploded view - coolant pump/thermostat", page 169](#)

⇒ ["2.2 Exploded view - electric coolant pump", page 170](#)

⇒ ["2.3 Removing and installing electric coolant pump", page 170](#)

⇒ ["2.4 Removing and installing coolant pump", page 173](#)

⇒ ["2.5 Checking thermostat", page 173](#)

⇒ ["2.6 Removing and installing 4/2-way valve with thermostat", page 173](#)

⇒ ["2.7 Removing and installing coolant temperature sender G62", page 176](#)

⇒ ["2.8 Removing and installing radiator outlet coolant temperature sender G83", page 177](#)

⇒ ["2.9 Removing and installing coolant valves", page 178](#)

2.1 Exploded view - coolant pump/thermostat

1 - Coolant pump

- ☐ Removing and installing
⇒ [page 173](#)

2 - Bolt

- ☐ 15 Nm

3 - O-ring

- ☐ Renew

4 - O-ring

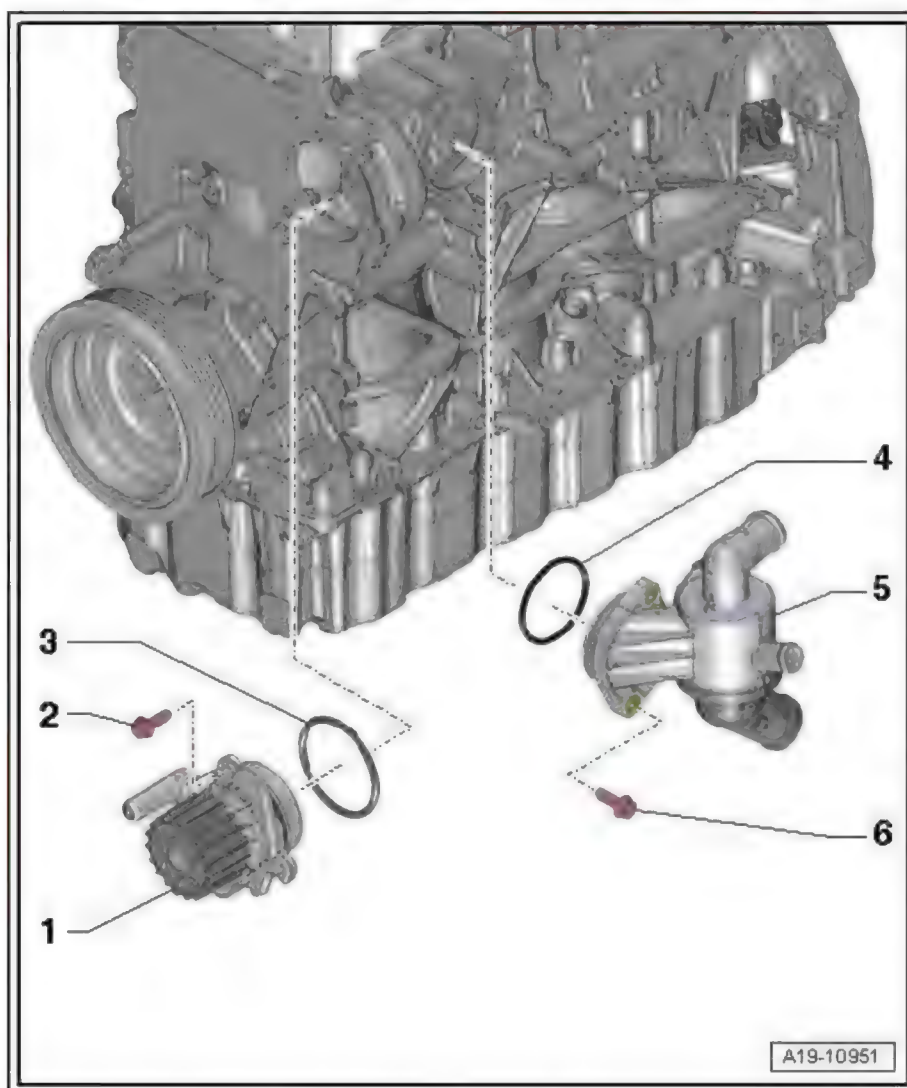
- ☐ Renew

5 - 4/2-way valve

- ☐ The thermostat is located in the interior of the 4/2-way valve and cannot be renewed separately
- ☐ Removing and installing
⇒ [page 173](#)

6 - Bolt

- ☐ 15 Nm



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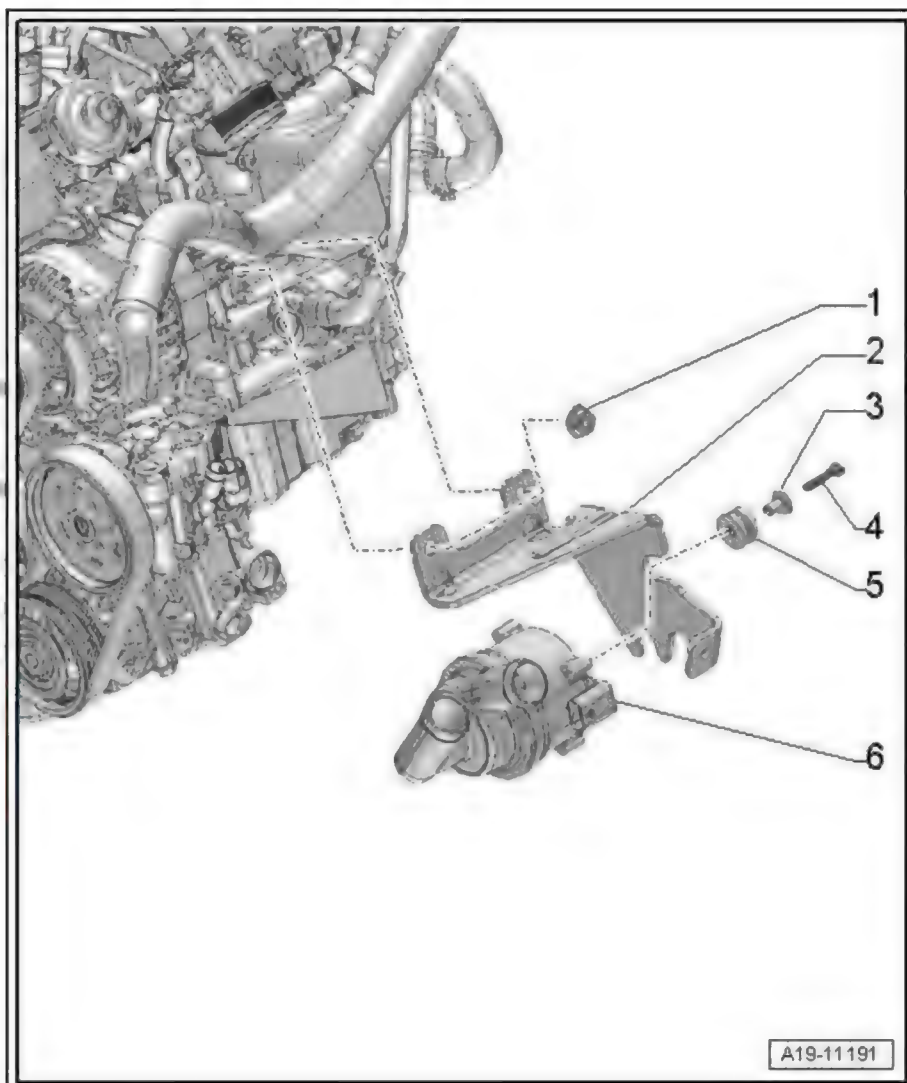
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2.2 Exploded view - electric coolant pump

- 1 - Nut
 - 9 Nm
- 2 - Bracket
 - For pump for exhaust gas recirculation cooler - V400-
- 3 - Spacer bush
- 4 - Bolt
 - 2.7 Nm
- 5 - Grommet
- 6 - Pump for exhaust gas recirculation cooler - V400-
 - Removing and installing
⇒ [page 170](#)



2.3 Removing and installing electric coolant pump

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-



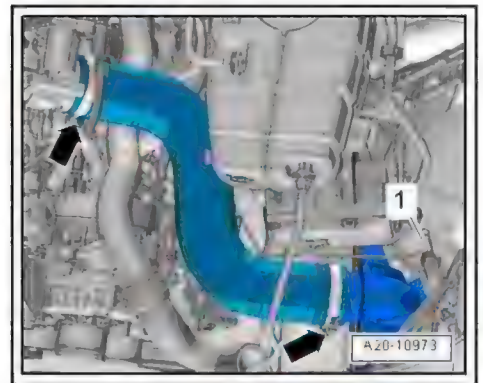


- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove engine cover panel ➔ [page 41](#) .
- Release hose clips -arrows- and remove air hose.



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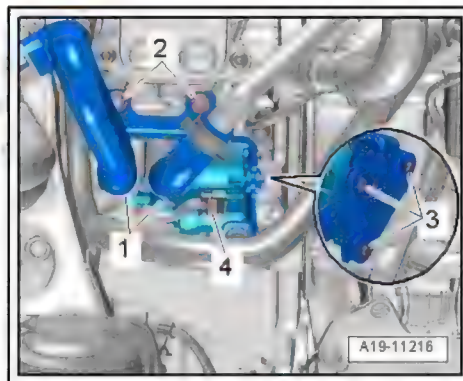
- Unplug electrical connector -4-.



WARNING

Risk of scalding due to hot steam and hot coolant.

- ◆ *The cooling system is under pressure when the power unit is hot.*
- ◆ *Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.*



- Remove nuts -2- and pull pump for exhaust gas recirculation cooler - V400- off engine.
- Clamp off coolant hoses using hose clamps -3094- , release hose clips -1- and disconnect coolant hoses.
- Remove bolts -3- and detach pump for exhaust gas recirculation cooler from bracket.

Installing

Installation is carried out in reverse order; note the following:



Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Check coolant level ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ [“2.2 Exploded view - electric coolant pump”, page 170](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 209](#)



2.4 Removing and installing coolant pump

Removing

- Drain coolant ➔ [page 162](#) .
- Remove toothed belt ➔ [page 83](#) .
- Unscrew bolts -1- and remove coolant pump -2-.
- Detach O-ring -3-.

Installing

Installation is carried out in reverse order; note the following:



Note

Fit new O-ring.

- Clean and smoothen sealing surface for O-ring.
- Lightly lubricate O-ring -3- with coolant.
- Fit coolant pump -2-.
- Installation position: Sealing plug in housing faces downwards.
- Install toothed belt (adjust valve timing) ➔ [page 87](#) .



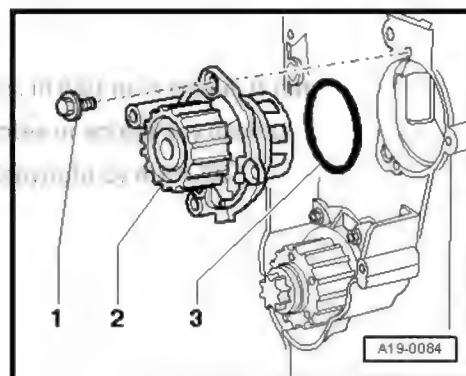
Note

Do not reuse coolant.

- Fill up with coolant ➔ [page 164](#) .

Tightening torques

- ♦ ➔ ["2.1 Exploded view - coolant pump/thermostat", page 169](#)



2.5 Checking thermostat

- Remove thermostat and heat it in a water bath.

Starts to open	Fully open	Opening travel
approx. 92 °C	approx. 107 °C ¹⁾	at least 7 mm
• ¹⁾ Cannot be tested.		

2.6 Removing and installing 4/2-way valve with thermostat

Special tools and workshop equipment required

◆ Removal lever - 80 - 200-



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◆ Articulated wrench, 10 mm - 3185-

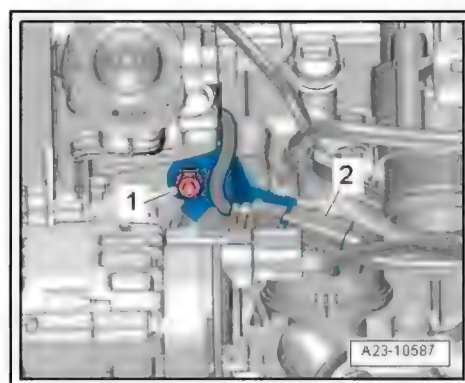


◆ Hose clip pliers - VAS 6340-



Removing

- Unscrew nut -1-.
- Move electrical connector -2- with bracket to one side.

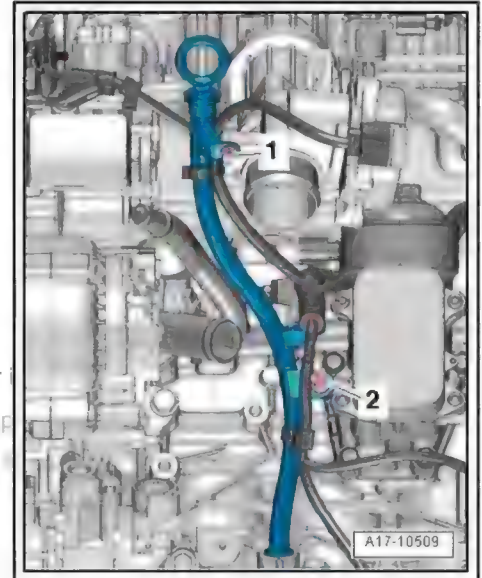




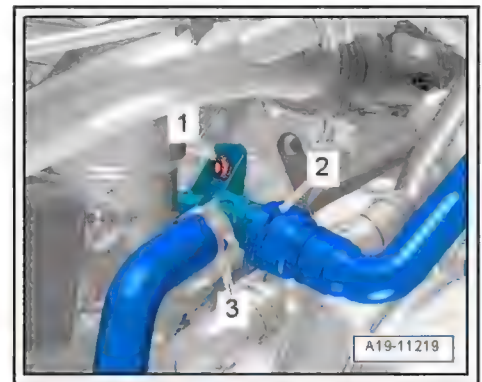
- Pull oil dipstick out slightly and remove bolt -1-.
- Release clip -2- with removal lever - 80 - 200- .
- Pull guide tube for oil dipstick upwards out of cylinder block and push to one side.



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- Remove bolt -1- and pull coolant pipe (bottom left) off 4/2-way valve.





- Remove bolts -2-.
- Release hose clips -3-, lift retaining clip -1- and detach coolant hoses.
- Detach 4/2-way valve with thermostat.

Installing

Installation is carried out in reverse order; note the following:



Note

- ◆ Fit new O-ring.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.
- Install dipstick guide tube.
- Install coolant pipe (bottom left) ⇒ [page 182](#).
- Connect coolant hose with plug-in connector ⇒ [page 190](#).



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#).

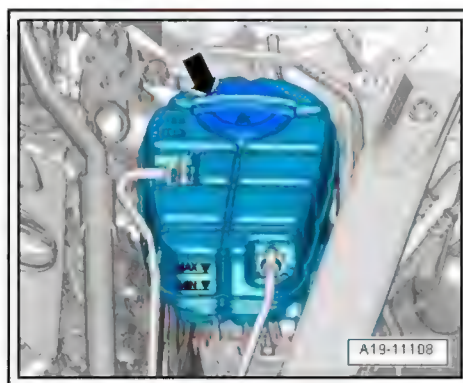
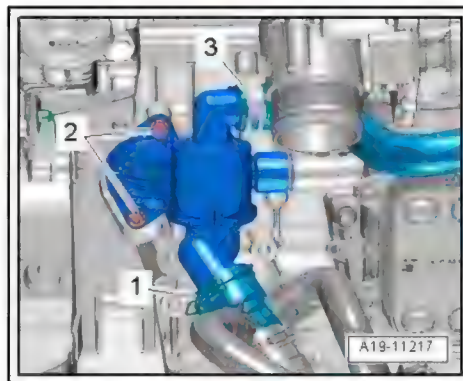
Tightening torques

- ◆ ⇒ [“2.1 Exploded view - coolant pump/thermostat”, page 169](#)

2.7 Removing and installing coolant temperature sender - G62-

Removing

- Engine cold.
- Remove engine cover panel ⇒ [page 41](#).
- To relieve residual pressure in cooling system, open filler cap -arrow- on coolant expansion tank briefly and then close cap again (it should click into place).





- Unplug electrical connector -2-.
- Pull off retaining clip -1- and pull out coolant temperature sender - G62- .

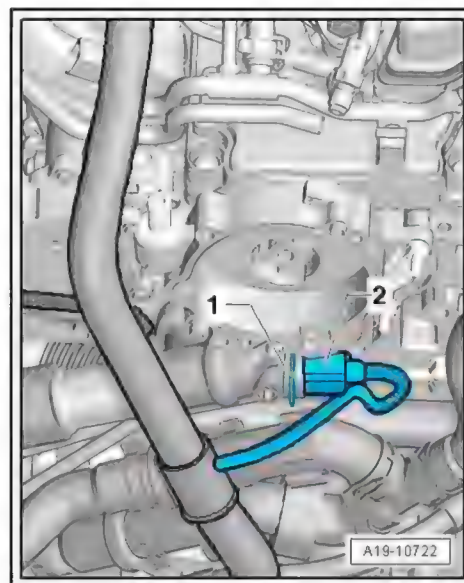
Installing

Installation is carried out in reverse order; note the following:



Note

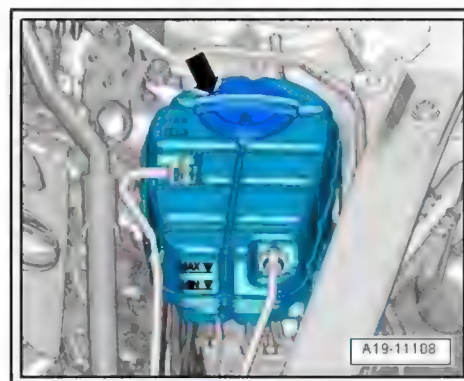
- ◆ *Fit new O-ring.*
- ◆ *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*
- Check coolant level ⇒ [page 168](#) .



2.8 Removing and installing radiator outlet coolant temperature sender - G83-

Removing

- Engine cold.
- To relieve residual pressure in cooling system, open filler cap -arrow- on coolant expansion tank briefly and then close cap again (it should click into place).
- Remove engine cover panel ⇒ [page 41](#) .



- Unplug electrical connector -2-.



Note

Place a cloth underneath to catch escaping coolant.

- Unscrew radiator outlet coolant temperature sender - G83- -item 1-.

Installing

Installation is carried out in reverse order; note the following:

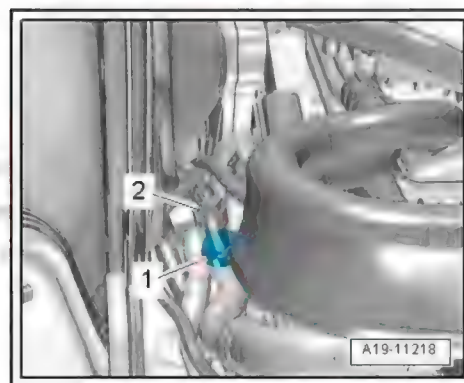


Note

- ◆ *Fit new O-rings.*
- ◆ *Insert new radiator outlet coolant temperature sender - G83- immediately into threaded hole to avoid loss of coolant.*
- Check coolant level ⇒ [page 168](#) .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - coolant pipes", page 179](#)





2.9 Removing and installing coolant valves

Removing

- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Unplug electrical connector -3-.



Note

Place a cloth under gearbox oil cooling valve to catch escaping coolant.

- Release hose clips -1, 2- and disconnect coolant hoses.
- Remove bolts -arrows-.
- Remove gearbox oil cooling valve.

Installing

Installation is carried out in reverse order; note the following:



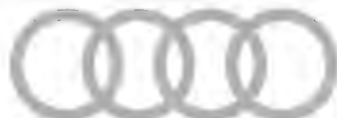
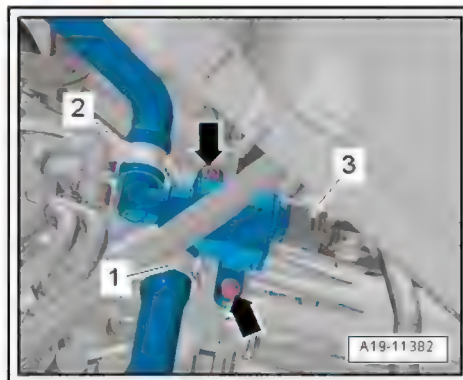
Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Check coolant level ⇒ [page 168](#) .

Tightening torques

- ◆ 9 Nm
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



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3 Coolant pipes

⇒ "3.1 Exploded view - coolant pipes", page 179

⇒ "3.2 Removing and installing coolant pipes", page 181

3.1 Exploded view - coolant pipes

Coolant pipes on engine

1 - Bolt

□ 9 Nm

2 - Coolant pipe (bottom left)

□ Removing and installing
⇒ [page 182](#)

3 - O-ring

□ Renew

4 - Thermostat

□ For exhaust gas recirculation cooler

5 - Coolant pipe (rear right)

□ Removing and installing
⇒ [page 183](#)

6 - Bolt

□ 9 Nm

7 - Nut

□ 9 Nm

8 - Retaining clip

9 - Coolant temperature sender - G62-

□ Removing and installing
⇒ [page 176](#)

10 - O-ring

□ Renew

11 - Gasket

□ Renew

12 - Bolt

□ 9 Nm

13 - Connection

□ For coolant hoses

14 - Radiator outlet coolant temperature sender - G83-

□ Removing and installing ⇒ [page 177](#)

□ 2 Nm

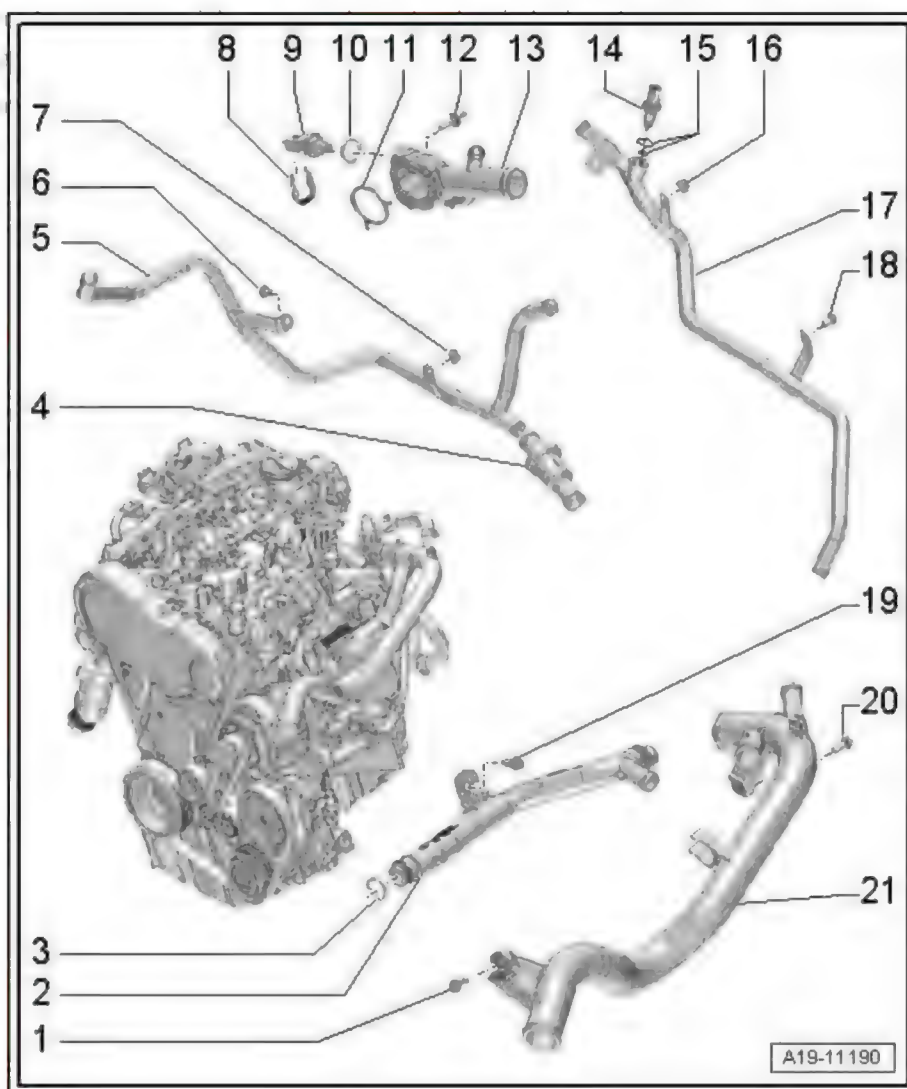
15 - O-rings

□ Different diameters

□ Renew

16 - Nut

□ 9 Nm



A19-11190



17 - Coolant pipe (rear)

- ❑ Removing and installing ⇒ [page 185](#)

18 - Bolt

- ❑ 9 Nm

19 - Bolt

- ❑ 9 Nm

20 - Bolt Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not

- ❑ 9 Nm permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability

21 - Coolant pipe (top left) he correctness of information in this document. Copyright by AUDI AG.

- ❑ Removing and installing ⇒ [page 181](#)

Coolant pipes on multitronic gearbox

1 - Bolt

- ❑ 9 Nm

2 - Gearbox oil cooling valve - N509-

- ❑ Removing and installing ⇒ [page 178](#)

3 - Bolt

- ❑ 20 Nm

4 - Bracket

- ❑ For gearbox oil cooling valve - N509-

5 - Bolt

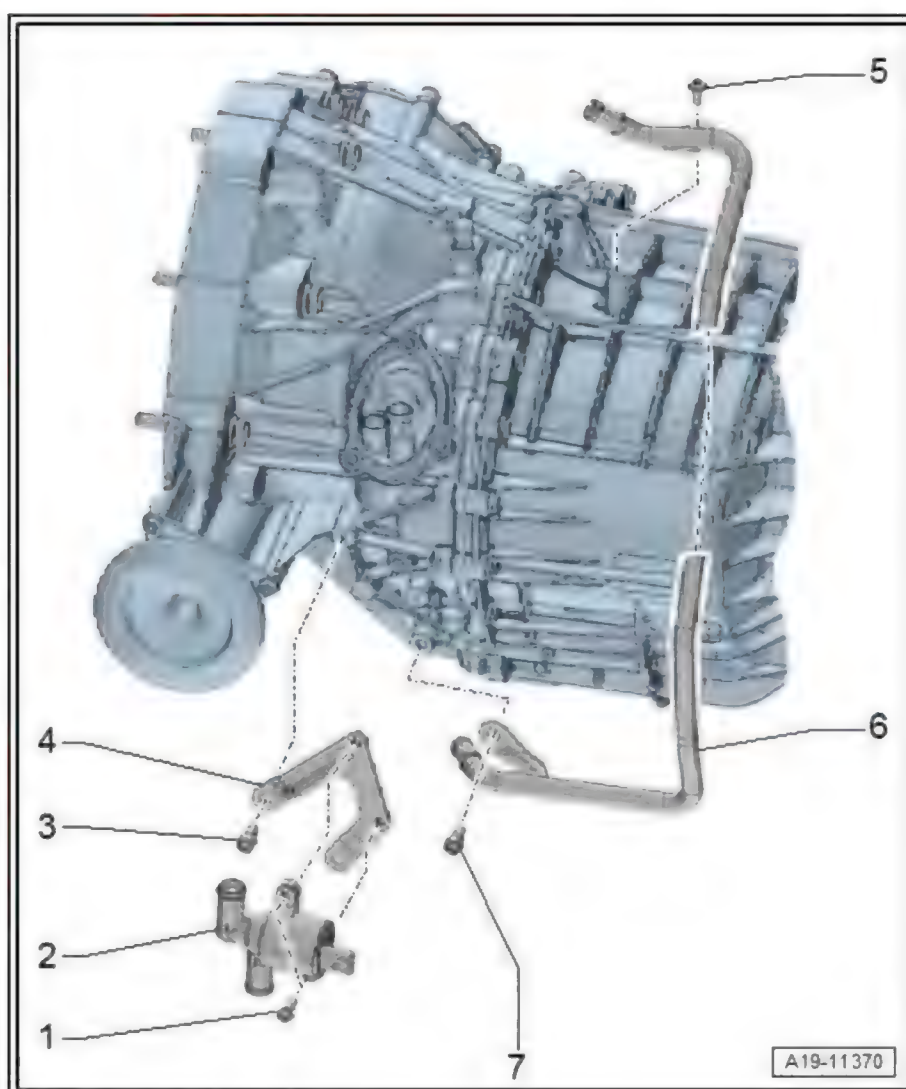
- ❑ 9 Nm

6 - Coolant pipe

- ❑ Removing and installing ⇒ [page 187](#)

7 - Bolt

- ❑ 20 Nm





3.2 Removing and installing coolant pipes

⇒ "3.2.1 Removing and installing coolant pipe (top left)",
page 181

⇒ "3.2.2 Removing and installing coolant pipe (bottom left)", page
182

⇒ "3.2.3 Removing and installing coolant pipe (rear right)",
page 183

⇒ "3.2.4 Removing and installing coolant pipe (rear)", page 185

⇒ "3.2.5 Removing and installing coolant pipe on multitronic gear-
box", page 187

3.2.1 Removing and installing coolant pipe (top left)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Drain coolant ⇒ [page 162](#) .
- Release hose clips -arrows- and remove air hose.



Note

Disregard -item 1-





- Remove bolts -1, 2-.
- Release hose clips -arrows- and disconnect coolant hoses from coolant pipe (top left).

Installing

Installation is carried out in reverse order; note the following:



Note

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Do not reuse coolant.*

- Fill up with coolant ⇒ [page 164](#) .

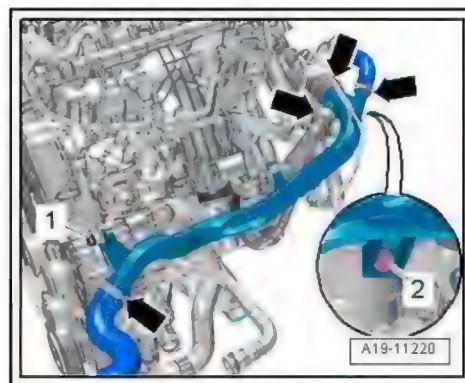
Tightening torques

- ◆ ⇒ [“3.1 Exploded view - coolant pipes”, page 179](#)
- ◆ ⇒ [“2.2 Exploded view - hose connections for charge air system”, page 209](#)

3.2.2 Removing and installing coolant pipe (bottom left)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

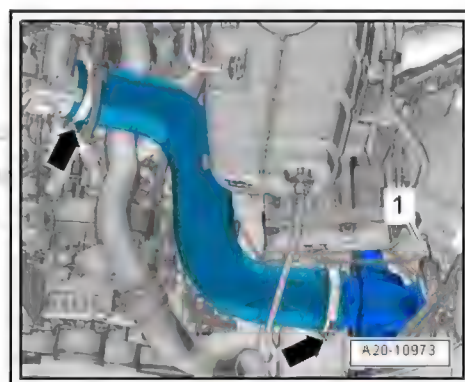
- Remove engine cover panel ⇒ [page 41](#) .
- Drain coolant ⇒ [page 162](#) .
- Release hose clips -arrows- and remove air hose.



Note

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- Release hose clip -3-, lift retaining clip -2- and detach coolant hoses.
- Remove bolt -1- and pull coolant pipe (bottom left) off 4/2-way valve.

Installing

Installation is carried out in reverse order; note the following:



Note

- ◆ *Fit new O-ring.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*
- Install air hoses with screw-type clips
⇒ ["2.2 Exploded view - hose connections for charge air system", page 209](#) .
- Connect coolant hose with plug-in connector ⇒ [page 190](#) .
- Check coolant level ⇒ [page 168](#) .

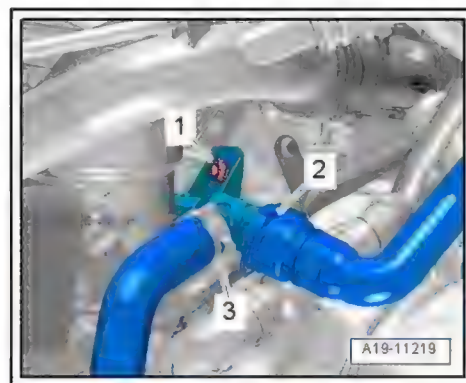
Tightening torques

- ◆ ⇒ ["3.1 Exploded view - coolant pipes", page 179](#)

3.2.3 Removing and installing coolant pipe (rear right)

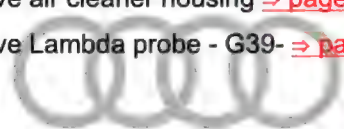
Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Drain coolant ⇒ [page 162](#) .
- Remove plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .
- Remove air cleaner housing ⇒ [page 227](#) .
- Remove Lambda probe - G39- ⇒ [page 266](#) .



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Caution

Risk of damage to flexible joints in front exhaust pipe

- ◆ *Do not bend flexible joints in front exhaust pipe more than 10°.*

- Loosen bolts -arrows-, push back clamp and tie up front exhaust pipe.

- Remove bolt -2- on mounting for particulate filter.



Note

Disregard -item 1-.

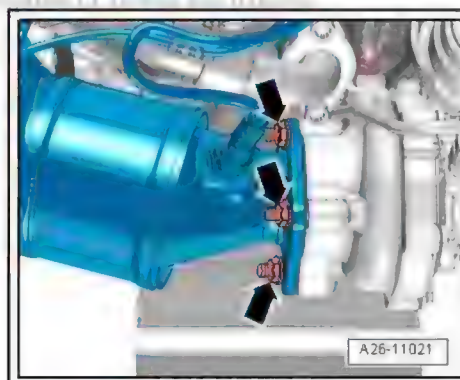
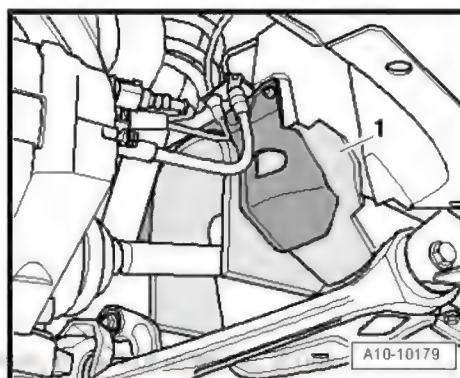
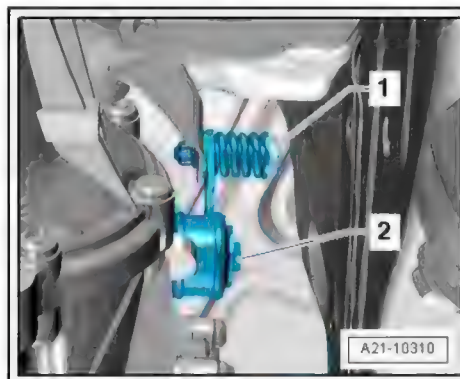
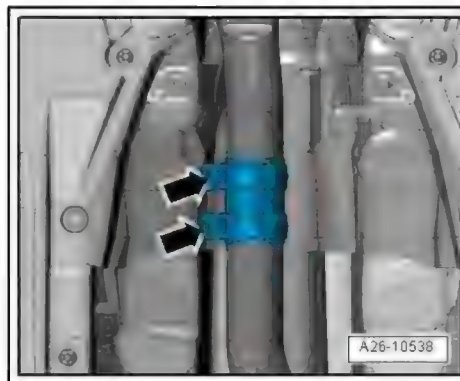
- Remove cover -1- for drive shaft in wheel housing (left-side).



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- Remove nuts -arrows- and press particulate filter to rear.





- Move electrical wiring harness clear.
- Remove bolt and nut -arrows-.
- Release hose clips -1, 2, 3- and disconnect coolant hoses from coolant pipe (rear right).

Installing

Installation is carried out in reverse order; note the following:



Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue* .

- Install particulate filter ⇒ [page 281](#) .
- Install Lambda probe - G39- ⇒ [page 266](#) .
- Install air cleaner housing ⇒ [page 227](#) .
- Install plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .



Note

Do not reuse coolant.

- Fill up with coolant ⇒ [page 164](#) .

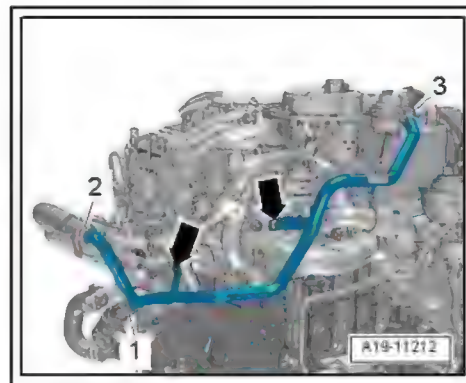
Tightening torques

- ◆ ⇒ ["3.1 Exploded view - coolant pipes", page 179](#)

3.2.4 Removing and installing coolant pipe (rear)

Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-

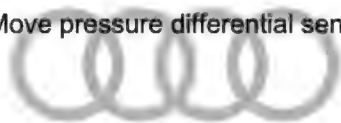


Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Drain coolant ⇒ [page 162](#) .
- Remove plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .
- Remove air cleaner housing ⇒ [page 227](#) .

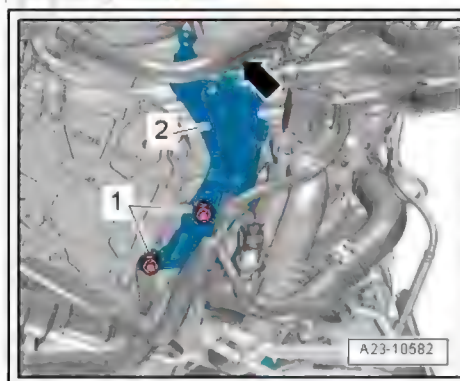
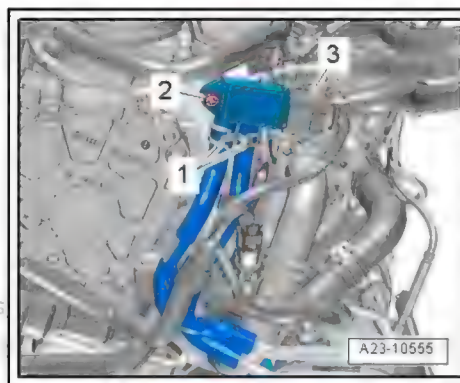


- Unplug electrical connector -3- for pressure differential sender - G505- .
- Remove bolt -2- and move hoses -1- clear at bracket.
- Move pressure differential sender - G505- to rear.

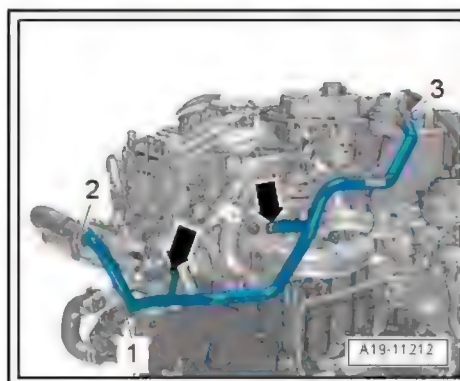


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- Move clear electrical wiring harness -arrow-.
- Remove nuts -1- and detach bracket -2-.



- Remove bolt and nut -arrows-.
- Release hose clips -1, 2, 3- and disconnect coolant hoses from coolant pipe (rear right).
- Press coolant pipe (rear right) to one side.





- Unplug electrical connector -3-.
- Remove bolt -1-.
- Release hose clips -arrows- and disconnect coolant hoses from rear coolant pipe.



Note

Disregard -item 2-.

Installing

Installation is carried out in reverse order; note the following:



Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Install pressure differential sender - G505- ⇒ [page 282](#) .
- Install air cleaner housing ⇒ [page 227](#) .
- Install plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .



Note

Do not reuse coolant.

Fill up with coolant ⇒ [page 164](#) .

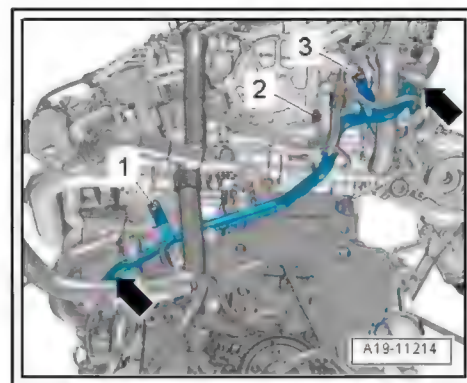
Tightening torques

◆ ⇒ [3.1 Exploded view - coolant pipes](#) , [page 179](#)

3.2.5 Removing and installing coolant pipe on multitronic gearbox

Special tools and workshop equipment required

- ◆ Hose clamps up to 25 mm - 3094-





◆ Drip tray for workshop hoist - VAS 6208-



Removing

- Remove engine cover panel ⇒ [page 41](#) .
- Remove noise insulation (rear) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .
- Place drip tray for workshop hoist - VAS 6208- beneath gearbox.
- Clamp off coolant hoses using hose clamps -3094- , release hose clips -1, 2- and disconnect coolant hoses.
- Remove bolts -arrows-.
- Detach coolant pipe.

Installing

Installation is carried out in reverse order; note the following:

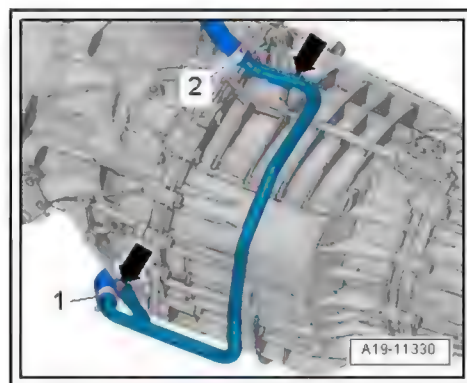


Note

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Do not reuse coolant.*
- Fill up with coolant ⇒ [page 164](#) .

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - coolant pipes", page 179](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



4 Radiator/radiator fan(s)

⇒ "4.1 Exploded view - radiator/radiator fan(s)", page 189

⇒ "4.2 Exploded view - radiator cowl and radiator fan",
page 191

⇒ "4.3 Removing and installing radiator", page 192

⇒ "4.4 Removing and installing radiator cowl", page 195

⇒ "4.5 Removing and installing radiator fan V7", page 199

4.1 Exploded view - radiator/radiator fan(s)

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1 - Air duct respect to the correct

2 - Coolant hose

- ☐ Lift retaining clip to detach
- ☐ Connecting
⇒ page 190

3 - O-ring

- ☐ Renew if damaged
- ☐ Lubricate with coolant

4 - Radiator

- ☐ Removing and installing
⇒ page 192
- ☐ If renewed, change coolant in entire system

5 - Coolant hose

- ☐ Lift retaining clip to detach
- ☐ Connecting
⇒ page 190

6 - O-ring

- ☐ Renew if damaged
- ☐ Lubricate with coolant

7 - Coolant pipe

- ☐ To coolant expansion tank
- ☐ Press release ring to detach
- ☐ Connecting
⇒ page 190

8 - O-ring

- ☐ Renew if damaged
- ☐ Lubricate with coolant

9 - Rubber bush

- ☐ For radiator

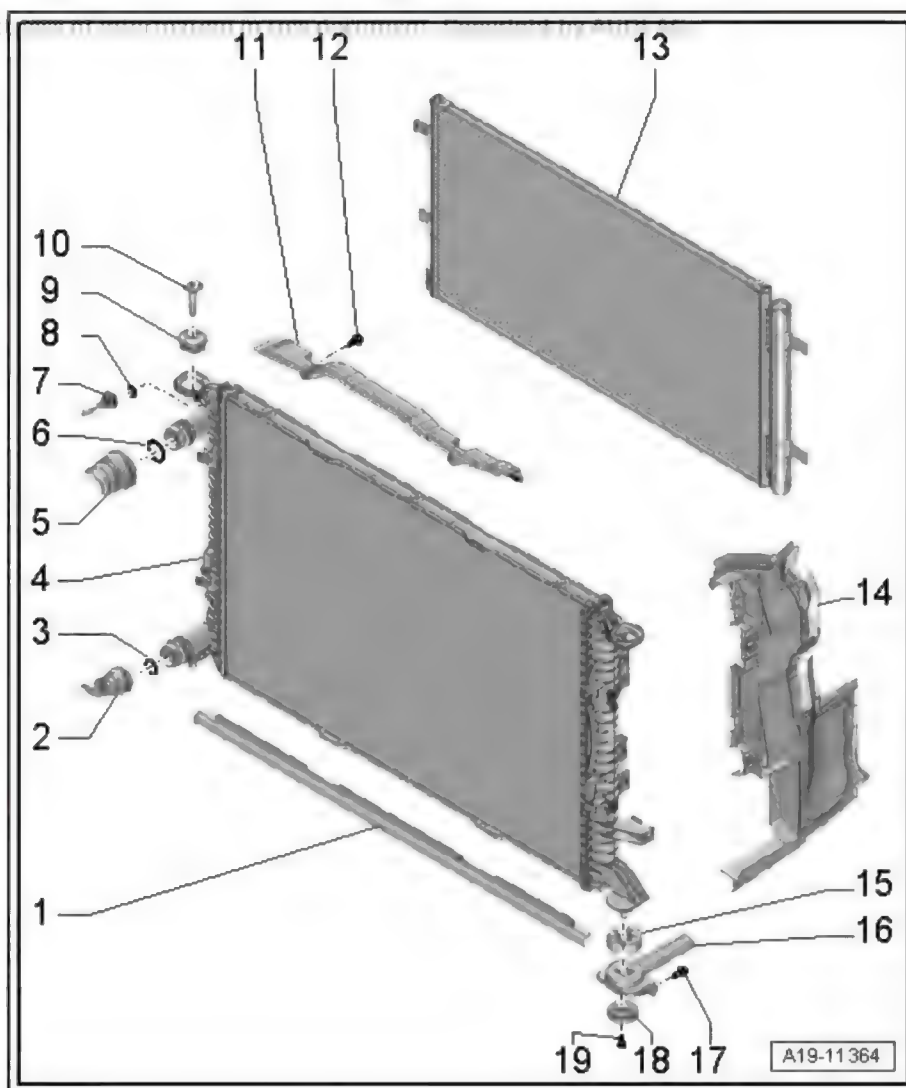
10 - Retaining pin

- ☐ Use screwdriver to release and pull off

11 - Air duct

12 - Bolt

- ☐ 2.5 Nm



13 - Condenser

- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser

14 - Air duct

15 - Rubber mounting

- ☐ For radiator

16 - Radiator bracket

17 - Bolt

- ☐ 5 Nm

18 - Support

19 - Bolt

- ☐ 4.5 Nm



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Connecting coolant hose with plug-in connector

- If damaged, renew retaining clip -4-.
- If damaged, renew O-ring. To do so, remove O-ring -2- from plug-in connector -3- using a suitable tool (do not use a sharp tool). Take care not to damage the plug-in connector or the surface on which the O-ring is seated.
- Lightly lubricate new O-ring with coolant and fit O-ring in coolant hose.
- Press coolant hose onto connection -1- until it engages audibly.
- Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.





4.2 Exploded view - radiator cowl and radiator fan

⇒ "4.2.1 Exploded view - radiator cowl and radiator fan, vehicles with manual gearbox", page 191

⇒ "4.2.2 Exploded view - radiator cowl and radiator fans, vehicles with multitronic gearbox", page 192

4.2.1 Exploded view - radiator cowl and radiator fan, vehicles with manual gearbox

1 - Radiator fan control unit - J293-

- ❑ Removing and installing
⇒ [page 200](#)

2 - Bolt

- ❑ 4.5 Nm

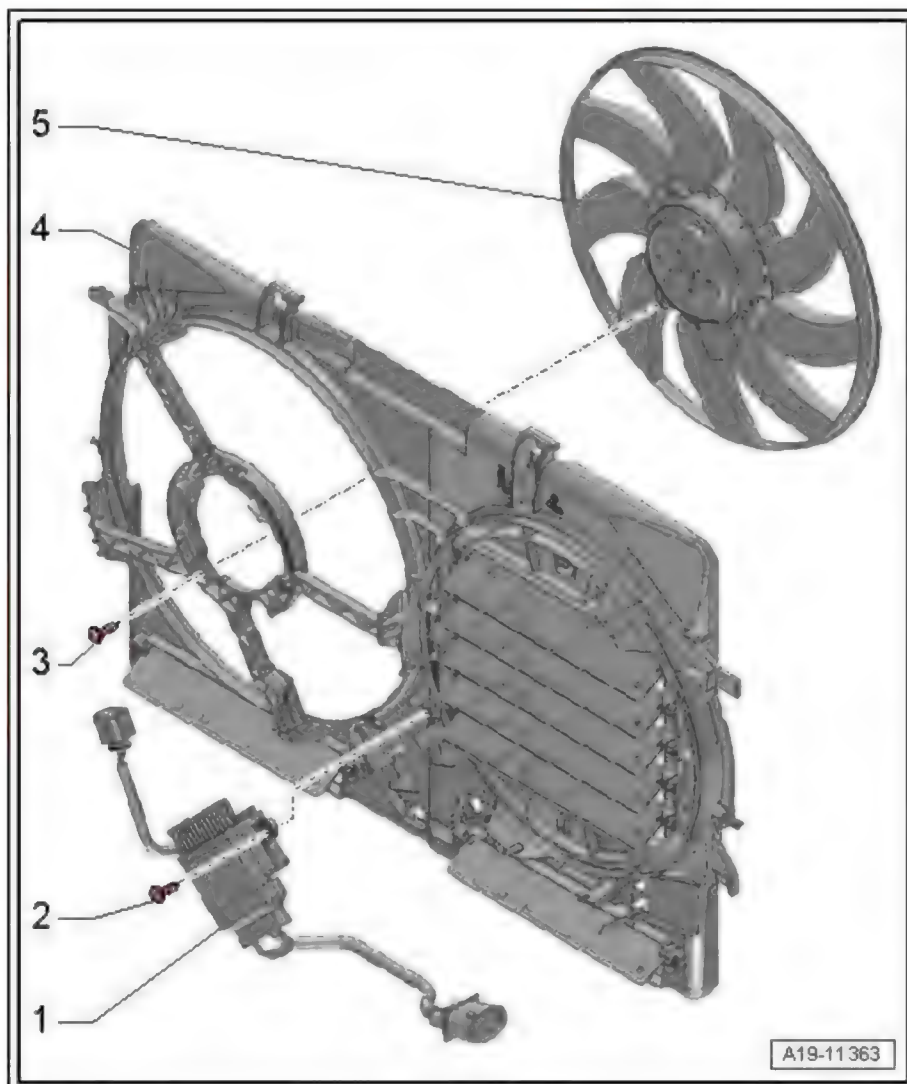
3 - Bolt

- ❑ 5 Nm

4 - Radiator cowl

5 - Radiator fan - V7-

- ❑ Removing and installing
⇒ [page 199](#)



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4.2.2 Exploded view - radiator cowl and radiator fans, vehicles with multitronic gearbox

1 - Radiator fan control unit

- ❑ Radiator fan control unit
- J293- with radiator fan control unit 2 - J671-
- ❑ Removing and installing
⇒ [page 200](#)

2 - Bolt

- ❑ 3.5 Nm

3 - Bolt

- ❑ 5 Nm

4 - Radiator cowl

- ❑ Removing and installing
⇒ [page 195](#)

5 - Radiator fan - V7-

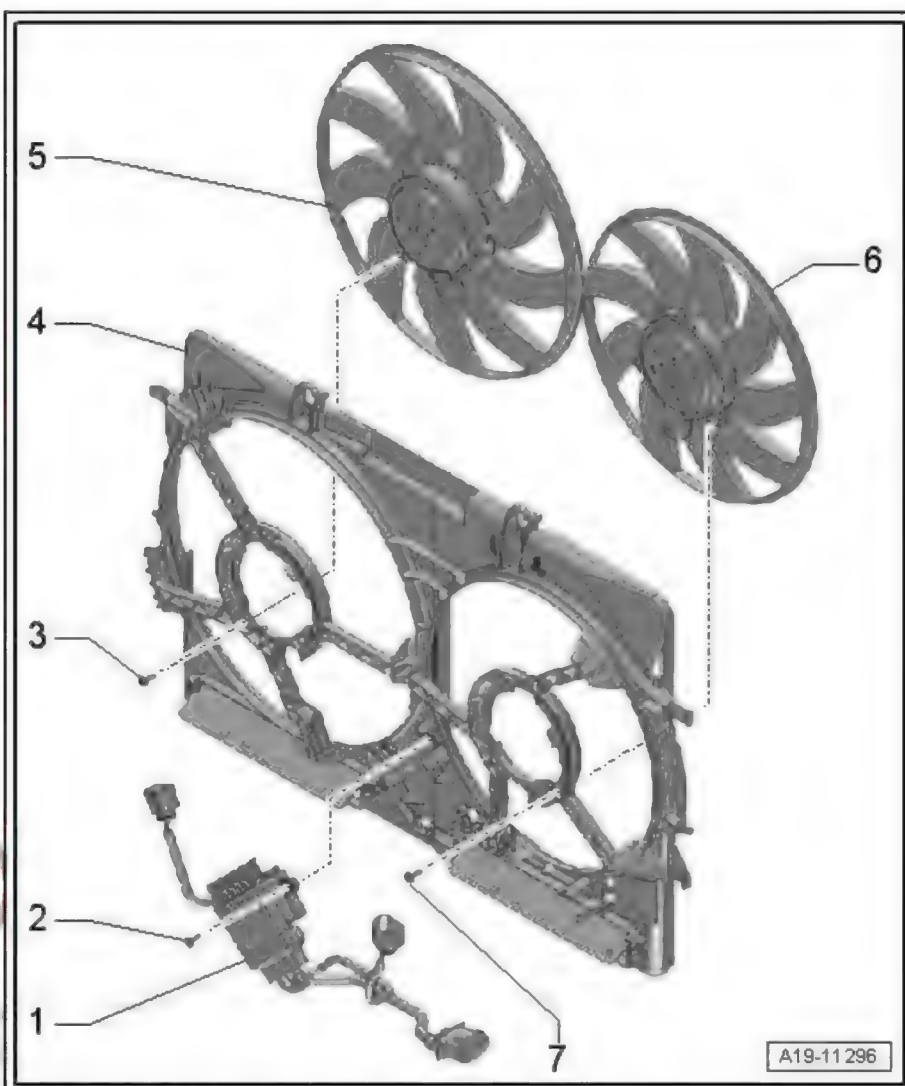
- ❑ Removing and installing
⇒ [page 200](#)

6 - Radiator fan 2 - V177-

- ❑ Removing and installing
⇒ [page 200](#)

7 - Bolt

- ❑ 5 Nm



4.3 Removing and installing radiator



Note

Radiator and radiator cowl are removed together.

Special tools and workshop equipment required



- ◆ Drip tray for workshop hoist - VAS 6208-

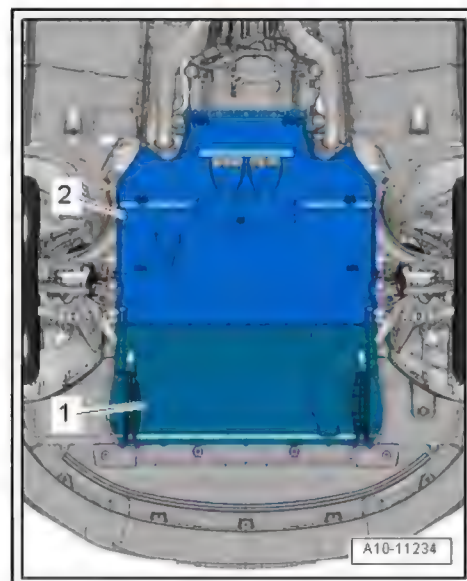


- ◆ Hose clip pliers - VAS 6362-



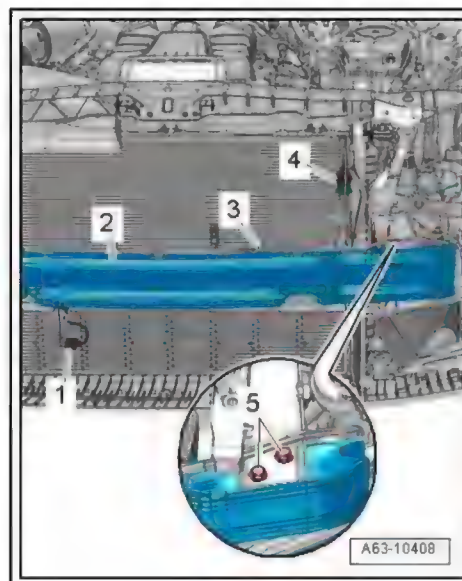
Removing

- Remove noise insulation (front) -1- ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

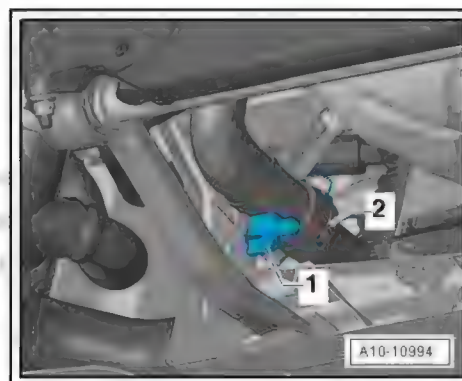


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- Remove impact absorber (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing impact absorber .
- Remove charge air cooler ⇒ [page 209](#) .
- Remove condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Open drain plug -1- at connection and drain off coolant.



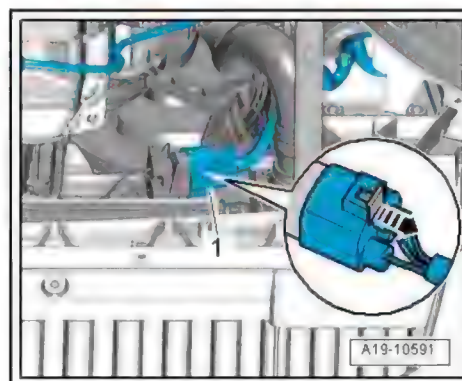
- Then lift retaining clip and detach connection -2- from radiator.



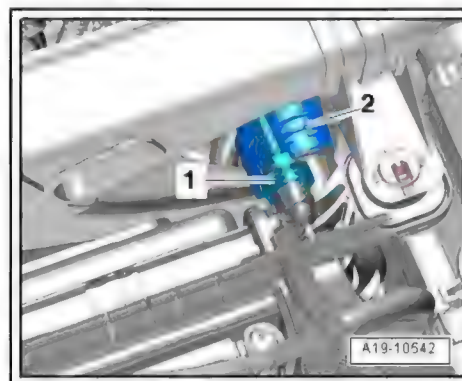
WARNING

Risk of injury as the radiator fans may start up automatically.

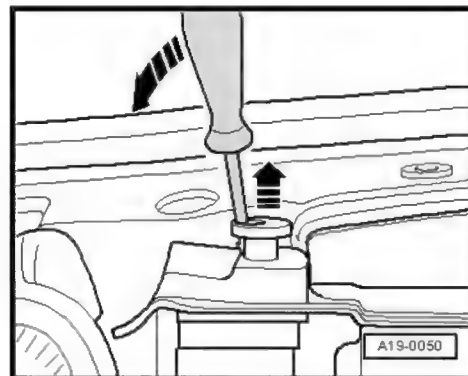
- ◆ *Unplug electrical connectors before working in vicinity of radiator cowl.*



- Take electrical connector -1- for radiator fan out of bracket and unplug connector (push retainer to the rear -arrow- and press down release catch).
- Lift retaining clips -1- and -2- and detach connection from radiator.



- Release retaining pins for radiator on both sides and pull out upwards -arrows-.



- Remove bolts -1- on both sides and detach radiator bracket with radiator from lock carrier -arrow-.
- Remove radiator with radiator cowl.



- Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.

Installing

Installation is carried out in reverse order; note the following:



Note

If there are slight impressions on the fins, refer to ➔ [page 8](#) .

- Connect coolant hose with plug-in connector ➔ [page 190](#) .



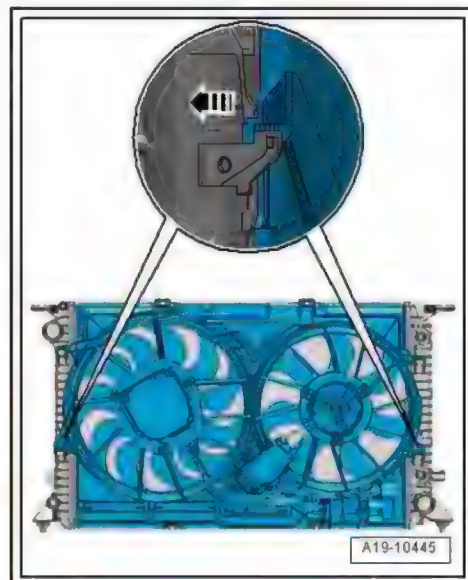
Note

Do not reuse coolant.

- Fill up with coolant ➔ [page 164](#) .

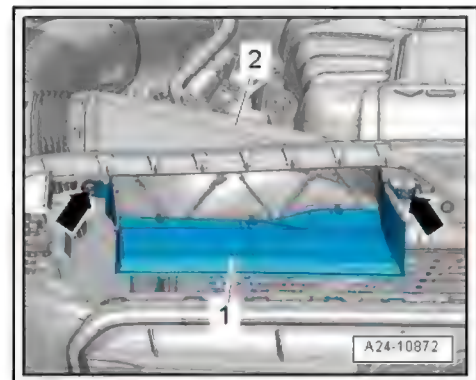
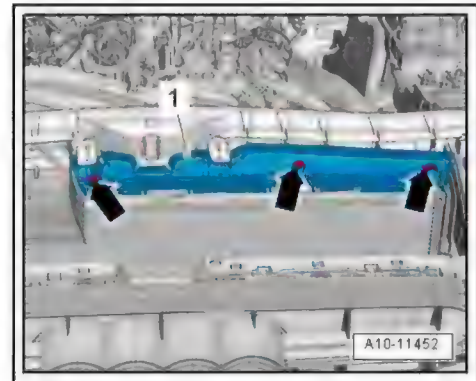
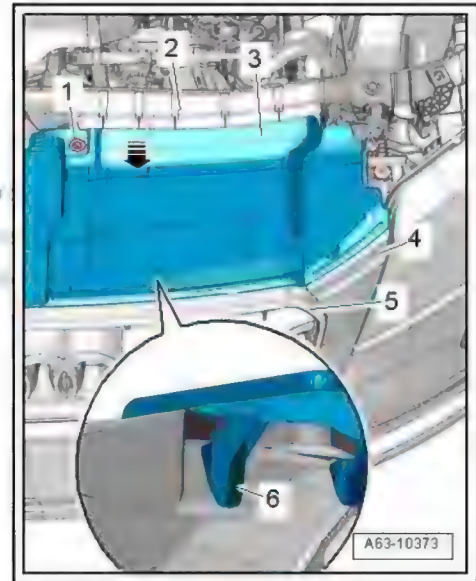
Tightening torques

- ◆ ➔ ["4.1 Exploded view - radiator/radiator fan\(s\)", page 189](#)
- ◆ ➔ ["3.1 Exploded view - air cleaner housing", page 226](#)
- ◆ Condenser ➔ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .
- ◆ Impact bar ➔ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments
- ◆ Noise insulation ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



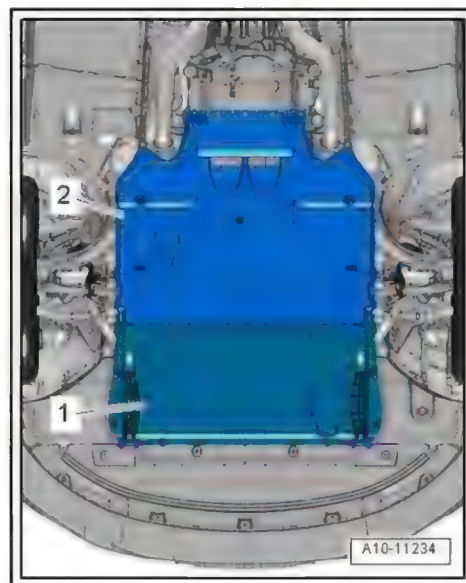
4.4 Removing and installing radiator cowl

Special tools and workshop equipment required

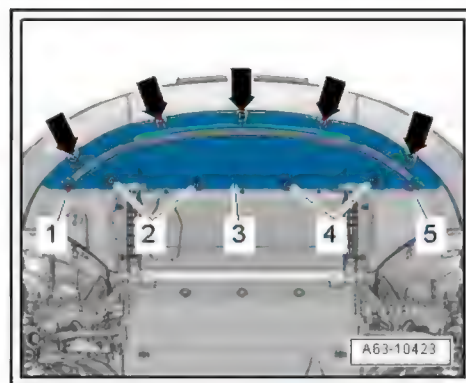




- Remove front noise insulation -1- ⇒ Rep. gr. 66 .



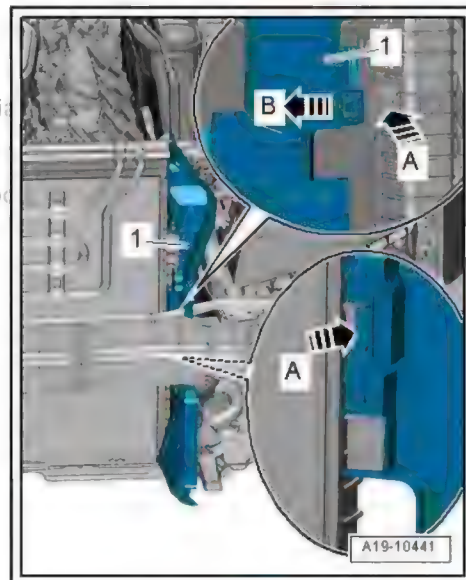
- Remove closure plate for bumper cover -3- ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .



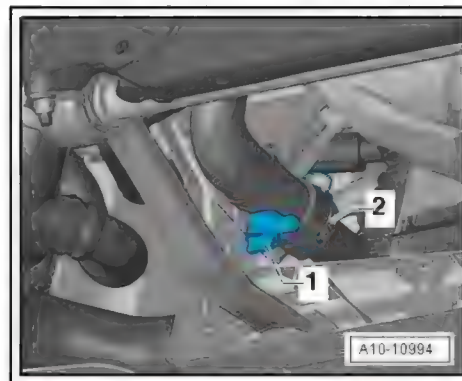
- Release catches -arrows A-, swivel air duct -1- on left and right to centre of vehicle -arrow B- and detach.



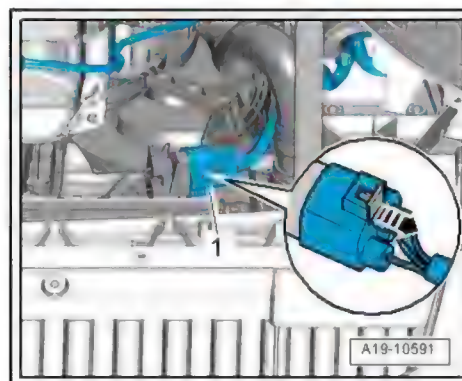
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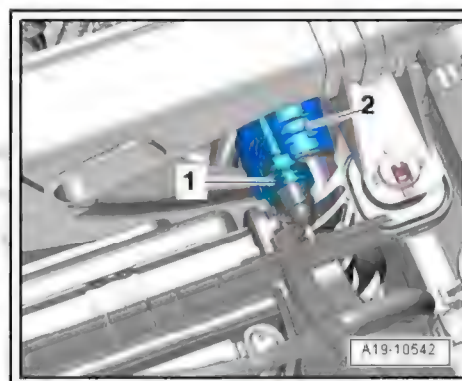
- Place drip tray for workshop hoist - VAS 6208- underneath.
- Open drain plug -1- at connection and drain off coolant.
- Then lift retaining clip and detach connection -2- from radiator.



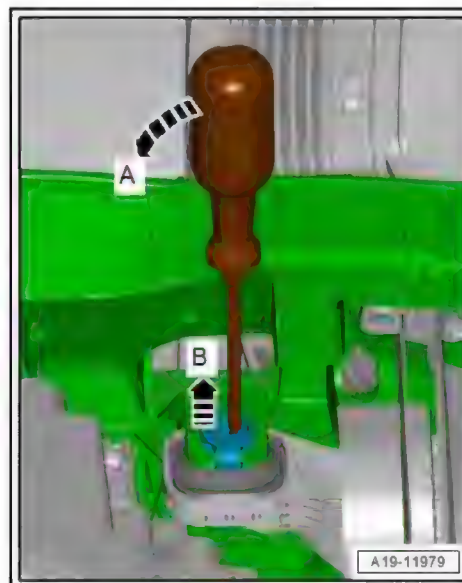
- Unplug electrical connector -1- for radiator fan (push retainer to the rear -arrow- and press down release catch).



- Release retaining clips -1 and 2- and detach connection from radiator.



- Release retaining pins for radiator on both sides -arrow A- and pull out upwards -arrow B-.





- Remove bolts -1- on both sides and detach radiator bracket with radiator from lock carrier -arrow-.
- Press radiator slightly towards front -arrow-.



- Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.

Installing

Installation is carried out in reverse order; note the following:

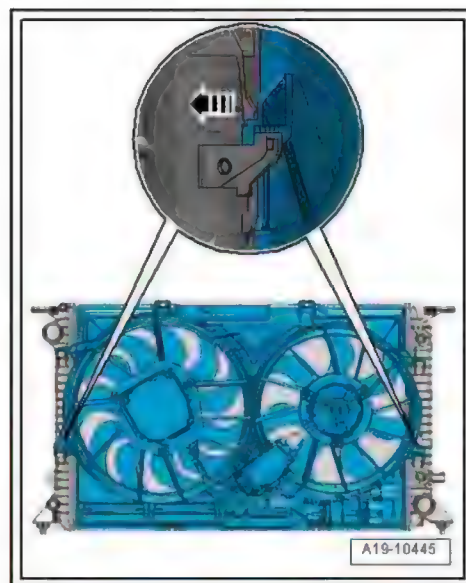
- Install air duct ➔ [page 226](#) .
- Install lock carrier cover and closure plate for bumper cover (front) ➔ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
- Connect coolant hose with plug-in connector ➔ [page 190](#) .



Note

Do not reuse coolant.

- Fill up with coolant ➔ [page 164](#) .



4.5 Removing and installing radiator fan - V7-

➔ ["4.5.1 Removing and installing radiator fan V7", page 199](#)

➔ ["4.5.2 Removing and installing radiator fans V7 / V177 - vehicles with multitronic gearbox", page 200](#)

➔ ["4.5.3 Removing and installing radiator fan control unit J293 / J671", page 200](#)

4.5.1 Removing and installing radiator fan - V7-

Removing



Note

Fit all cable ties in the original positions when installing.

- Remove radiator with radiator cowl ➔ [page 192](#) .



- Unplug electrical connector -1-.
- Unscrew bolts -arrows- and remove radiator fan - V7- .

Installing

Installation is carried out in reverse order; note the following:

- Install radiator with radiator cowl ⇒ [page 192](#) .

Tightening torques

- ♦ ⇒ ["4.2 Exploded view - radiator cowl and radiator fan", page 191](#)



4.5.2 Removing and installing radiator fans - V7- / -V177- - vehicles with multitronic gearbox

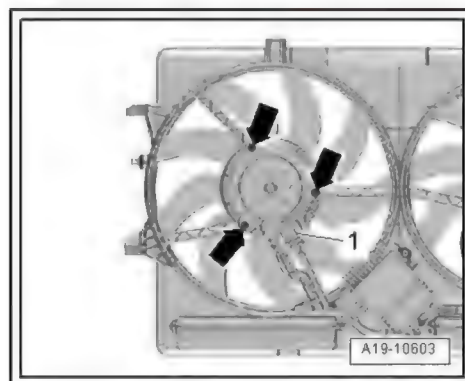
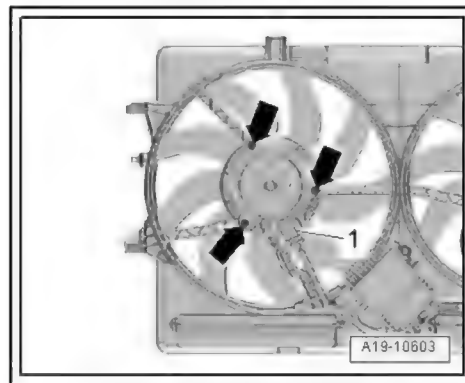
Removing



Note

Fit all cable ties in the original positions when installing.

- Remove radiator cowl ⇒ [page 195](#) .
- Unplug electrical connector -1-.
- Remove bolts -arrows- and detach radiator fan - V7- (left-side).



- Unplug electrical connector -1-.
- Remove bolts -arrows- and detach radiator fan 2 - V177- (right-side).

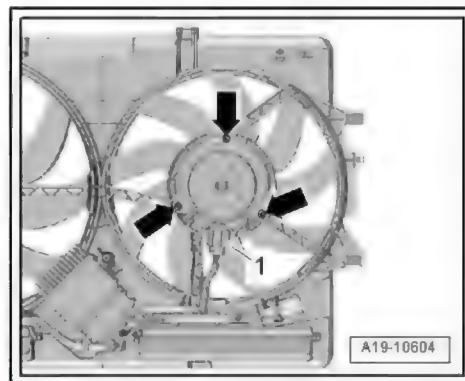
Installing

Installation is carried out in reverse order; note the following:

- Install radiator cowl ⇒ [page 195](#) .

Tightening torques

- ♦ ⇒ ["4.2.2 Exploded view - radiator cowl and radiator fans, vehicles with multitronic gearbox", page 192](#)



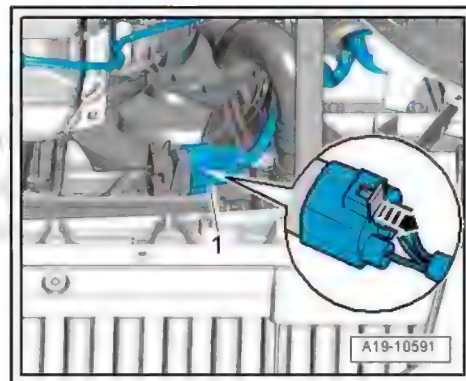
4.5.3 Removing and installing radiator fan control unit -J293- / -J671-

Removing

- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



- Take electrical connector -1- for radiator fan out of bracket and unplug connector (push retainer to the rear -arrow- and press down release catch).
- Move electrical wiring harness going to radiator fan control unit clear.



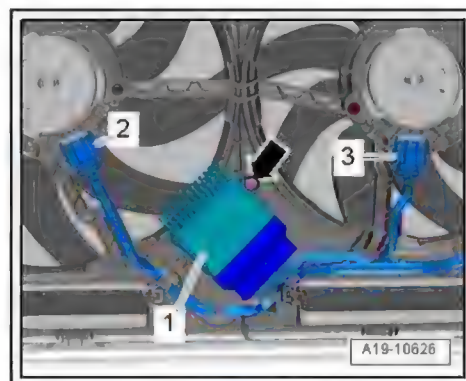
- Unplug electrical connectors -2, 3-.
- Unscrew bolt -arrow- and remove radiator fan control unit -1-.

Installing

Installation is carried out in reverse order; note the following:

Tightening torques

- ◆ ⇒ ["4.2 Exploded view - radiator cowl and radiator fan", page 191](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



21 – Turbocharging/supercharging

1 Turbocharger

⇒ "1.1 Exploded view - turbocharger", page 202

⇒ "1.2 Removing and installing turbocharger", page 203

1.1 Exploded view - turbocharger

1 - Air hose

2 - Pulsation damper

3 - Oil return line

4 - Bolt

☐ Renew

☐ 9 Nm

5 - Gasket

☐ Renew

6 - Threaded connection

☐ Renew after removing

☐ 40 Nm

7 - Gasket

☐ Renew

8 - Bolt

☐ 20 Nm

9 - Turbocharger

☐ Can only be renewed together with vacuum unit

☐ Adaption must be performed after renewing this component

☐ Select 01 - Engine electronics, functions and perform Guided Function 01 - Adaption after replacing positioner

☐ Removing and installing ⇒ [page 203](#)

10 - Gasket

☐ Renew

11 - Nut

☐ Renew

☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

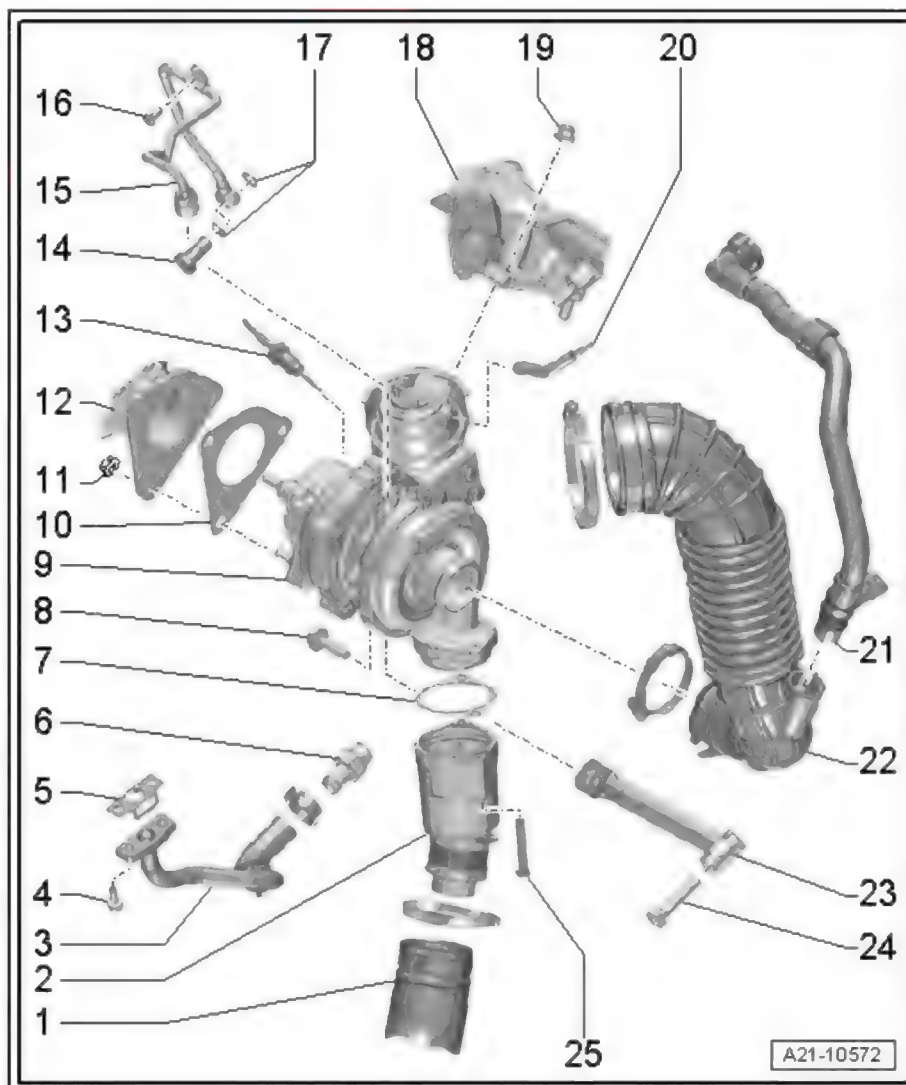
☐ 24 Nm

12 - Particulate filter

☐ Removing and installing ⇒ [page 281](#)

13 - Exhaust gas temperature sender 1 - G235-

☐ Exploded view ⇒ [page 284](#)





14 - Banjo bolt

- ☐ 30 Nm

15 - Oil supply line

- ☐ Check for obstructions
- ☐ Before installing, fill turbocharger with engine oil at connection for oil supply line
- ☐ Tighten union nuts to 22 Nm

16 - Bolt

- ☐ 9 Nm

17 - Seals

- ☐ Renew

18 - Exhaust manifold

- ☐ Removing and installing ⇒ [page 303](#)

19 - Nut

- ☐ Renew
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 24 Nm

20 - Vacuum hose

21 - Hose

- ☐ For crankcase breather
- ☐ Optional equipment for countries with cold climates: with heater element for crankcase breather - N79-

22 - Air pipe

23 - Support

- ☐ For turbocharger

24 - Bolt

- ☐ 24 Nm

25 - Bolt

- ☐ 9 Nm

1.2 Removing and installing turbocharger

Special tools and workshop equipment required

- ♦ Engine bung set - VAS 6122-



Removing



Note

Observe rules for cleanliness ⇒ [page 5](#).

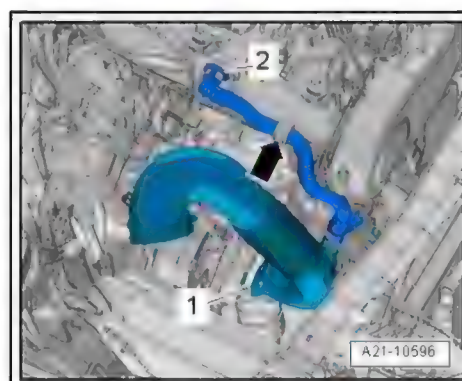


Caution

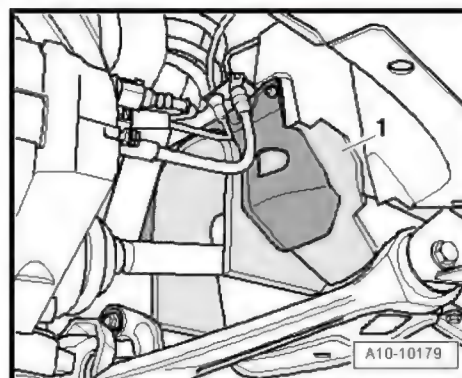
If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- ◆ Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.
- ◆ Check the entire charge air system (including the charge air cooler) for foreign matter.
- ◆ If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.

- Remove engine cover panel ⇒ [page 41](#) .
- Remove air cleaner housing ⇒ [page 227](#) .
- Press release tabs, disconnect crankcase breather hose -2- and move hose clear -arrow-.
- Loosen hose clip -1- and remove air hose.
- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



- Remove cover -1- for drive shaft in wheel housing (right-side).

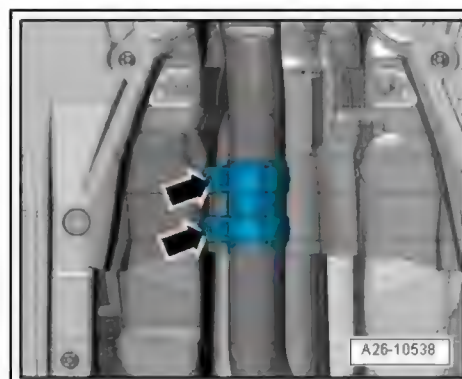


Caution

Risk of damage to flexible joints in front exhaust pipe

- ◆ Do not bend flexible joints in front exhaust pipe more than 10°.

- Loosen bolts -arrows-, push back clamp and tie up front exhaust pipe.



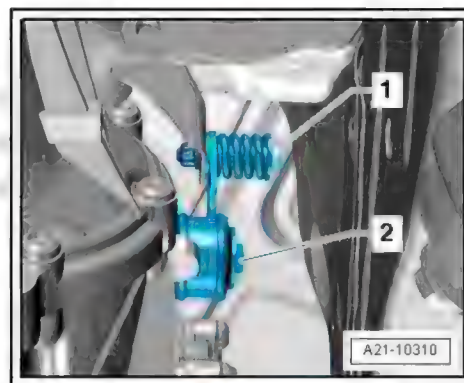
- Remove bolt -2- on mounting for particulate filter.



Note

permitted unless authorised by AUDI AG. AUDI AG does not guarantee the
Disregard -item 1-.

respect to the correctness of information in this document. Copy

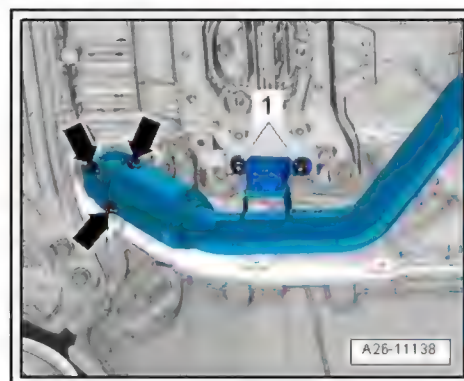


- Remove bolts -1-.

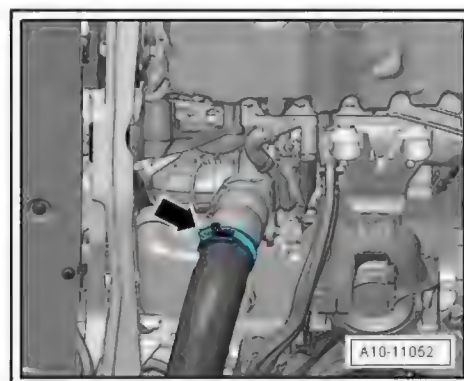


Note

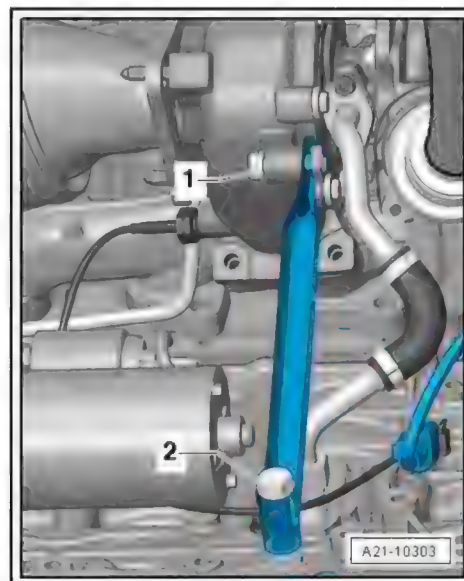
Disregard -arrows-.



- Release hose clip -arrow-, disconnect air hose and press to one side.



- Remove bolts -1- and -2- and take out support for turbocharger.



- Remove bolts -1-.
- Detach electrical connector -3- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.

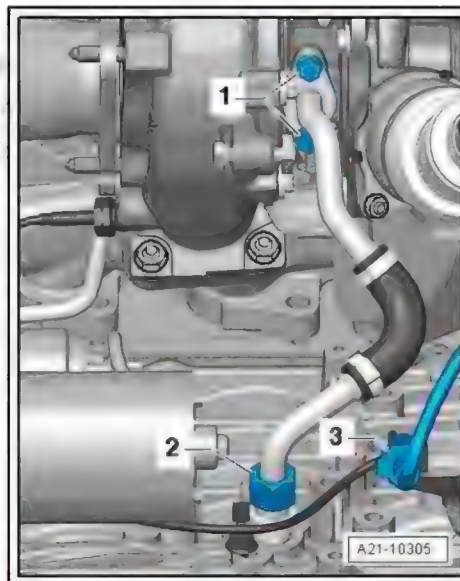
with respect to the correctness of information in this document. C



Note

Disregard -item 1-.

- Remove Lambda probe - G39- ➔ [page 266](#) .

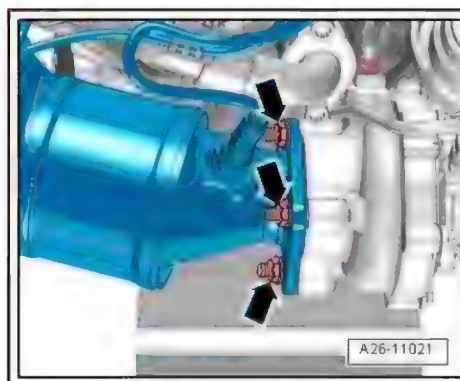


- Remove both nuts -bottom arrows-.

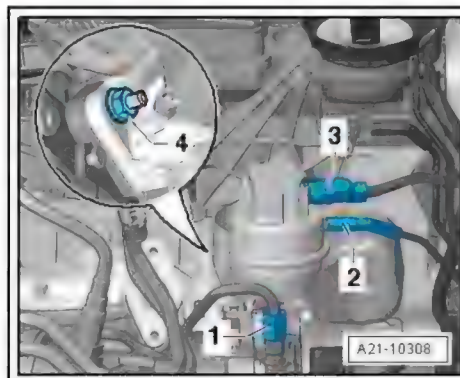


Note

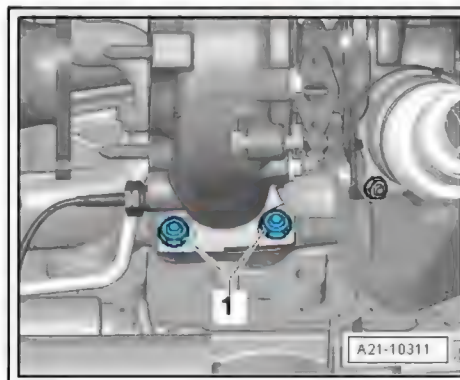
Nut -top arrow- is removed later.



- Remove union nut -1-.
- Disconnect vacuum hose -2-.
- Unplug electrical connector -3- for position sender for charge pressure positioner - G581- .
- Remove nut -4- securing turbocharger to exhaust manifold.



- Remove nuts -1-, pull turbocharger and particulate filter off studs and swivel to side as far as possible.





- Remove nut -top arrow- and disconnect turbocharger from particulate filter.



Caution

Risk of damage to oil supply line.

- ◆ *Do not attempt to bend oil supply line to a different shape.*

- Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

Installing

Installation is carried out in reverse order; note the following:



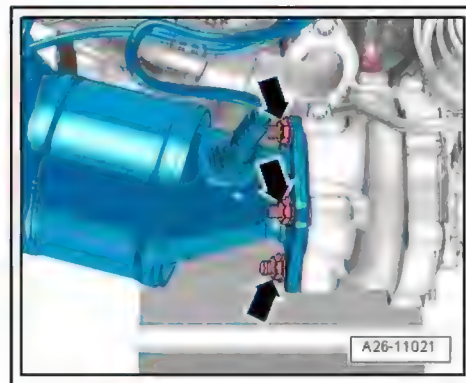
Note

- ◆ *Renew gasket/seal, nuts and O-ring.*
- ◆ *Fill turbocharger with engine oil at connection for oil supply line.*
- ◆ *After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.*
- Install particulate filter ⇒ [page 281](#) .
- Install Lambda probe - G39- ⇒ [page 266](#) .
- Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
- Install air cleaner housing ⇒ [page 227](#) .
- Adaption must be performed after renewing this component:
- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:

- ◆ **Drive train**
- ◆ **Select engine code and engine**
- ◆ **01 - Self-diagnosis compatible systems**
- ◆ **01 - Engine electronics**
- ◆ **01 - Engine electronics, functions**
- ◆ **01 - Adaption after replacing positioner**

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - turbocharger", page 202](#)
- ◆ ⇒ ["1.1 Exploded view - silencers", page 273](#)
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system", page 209](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



2 Charge air system

⇒ "2.1 Exploded view - charge air system", page 208

⇒ "2.2 Exploded view - hose connections for charge air system", page 209

⇒ "2.3 Removing and installing charge air cooler", page 209

⇒ "2.4 Removing and installing charge pressure sender G31", page 211

⇒ "2.5 Checking charge air system for leaks", page 211

2.1 Exploded view - charge air system

1 - Charge air cooler

- ☐ Removing and installing
⇒ page 209

2 - Hose clip

3 - Air hose

- ☐ To turbocharger
- ☐ Installing ⇒ page 209

4 - Hose clip

5 - Hose clip

6 - Air hose

- ☐ To intake manifold
- ☐ Installing ⇒ page 209

7 - Hose clip

8 - O-ring

- ☐ Renew

9 - Charge pressure sender - G31- / intake air temperature sender - G42-

- ☐ Removing and installing
⇒ page 211

10 - Bolt

- ☐ 5 Nm

11 - Rubber grommet

12 - Bush

13 - Nut

- ☐ 9 Nm

14 - Rubber grommet

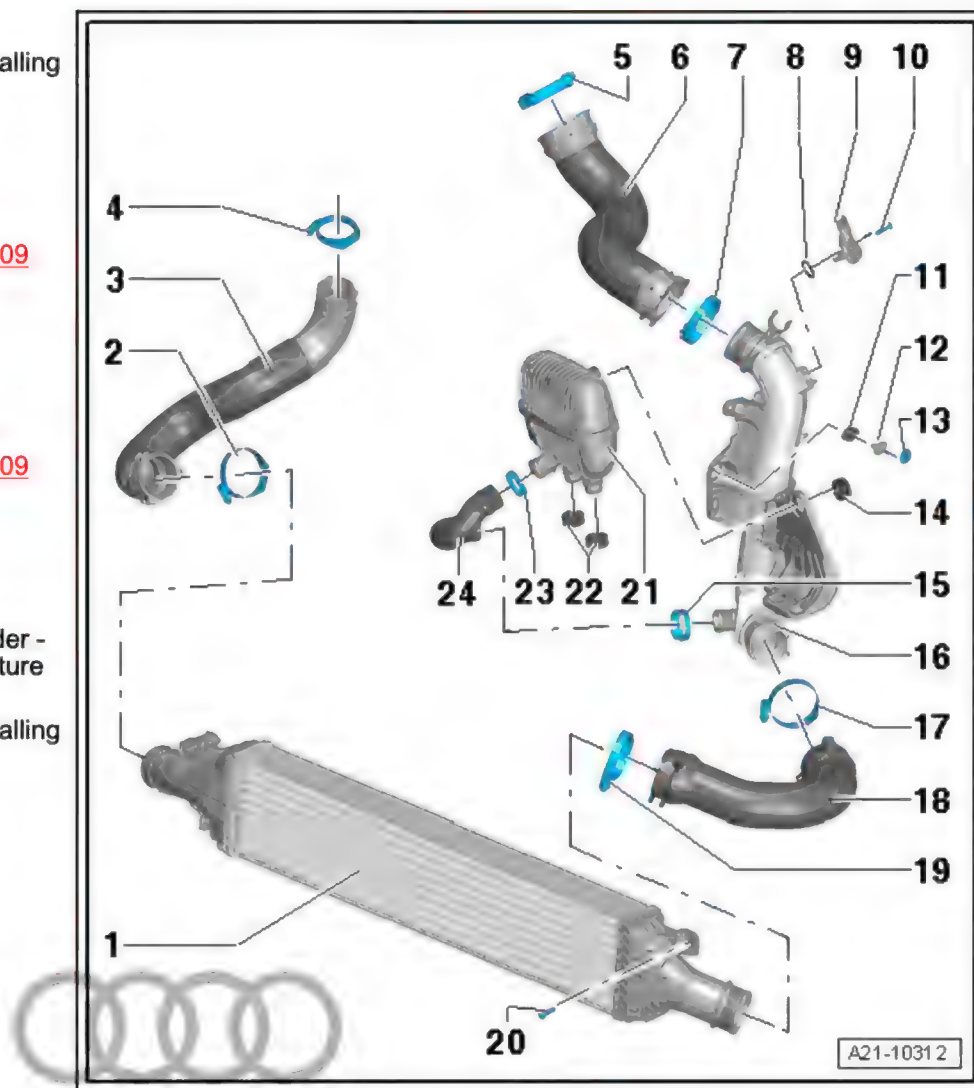
15 - Hose clip

16 - Air pipe

17 - Hose clip

18 - Air hose

- ☐ From charge air cooler
- ☐ Installing ⇒ page 209



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19 - Hose clip

20 - Bolt

□ 7 Nm

21 - Resonator

22 - Rubber grommet

23 - Hose clip

24 - Air hose

□ To resonator

□ Installing ➔ [page 209](#)



2.2 Exploded view - hose connections for charge air system

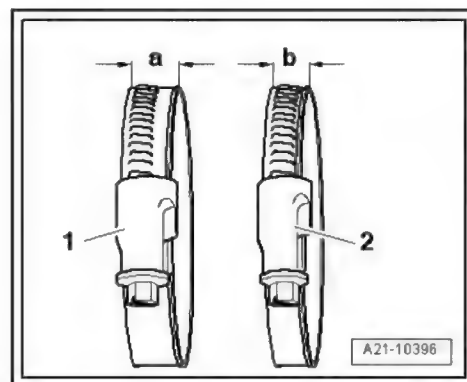


Note

- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ [Electronic parts catalogue](#) .*
- ◆ *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*

Tightening torque for

- 1 - Hose clip with width -a- = 13 mm: 5.5 Nm
- 2 - Hose clip with width -b- = 9 mm: 3 Nm



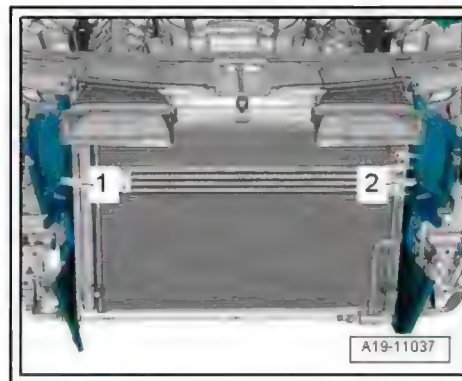
2.3 Removing and installing charge air cooler

Removing

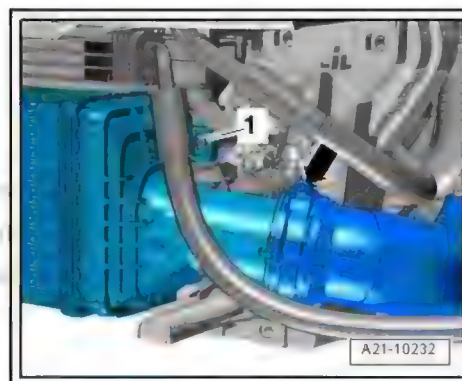
- Remove closure plate for bumper cover ➔ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .
- Remove lock carrier cover ➔ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .



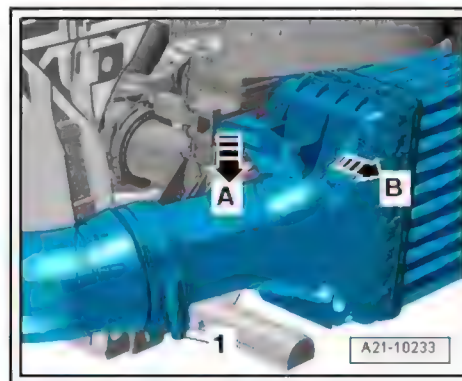
- Unclip air ducts -1 and 2-



- Release hose clip -arrow- and detach air hose from charge air cooler.
- Remove bolt -1-.



- Release hose clip -1- and detach air hose from charge air cooler.
- Push catch down -arrow A- and move top of charge air cooler slightly in direction of -arrow B-.
- Disengage and detach charge air cooler upwards.



Installing

Installation is carried out in reverse order; note the following:



Note

If there are slight impressions on the fins, refer to ⇒ [page 8](#) .

- Install lock carrier cover and closure plate at bumper cover ⇒
General body repairs, exterior; Rep. gr. 63 ; Bumper (front);
Exploded view - bumper cover .

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - charge air system", page 208](#)
- ◆ ⇒ ["2.2 Exploded view - hose connections for charge air system", page 209](#)



2.4 Removing and installing charge pressure sender - G31-

Removing

- Unplug electrical connector -1-.
- Unscrew bolts -arrows- and pull charge pressure sender - G31- out of air pipe.

Installing

Installation is carried out in reverse order; note the following:



Note

Fit new O-ring.

Tightening torques

- ◆ ⇒ ["2.1 Exploded view - charge air system", page 208](#)



2.5 Checking charge air system for leaks

Special tools and workshop equipment required

- ◆ Charge air system tester - V.A.G 1687-



Procedure



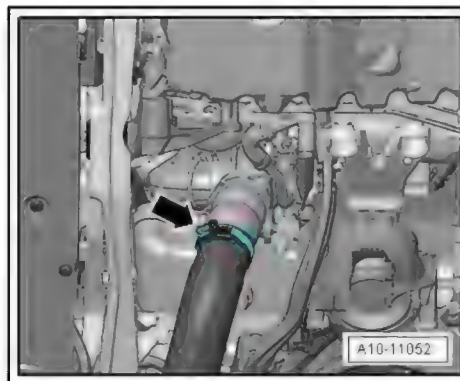
Note

Check that all air pipes and hoses and vacuum lines are correctly fitted and that there are no leaks before carrying out tests or repairs.

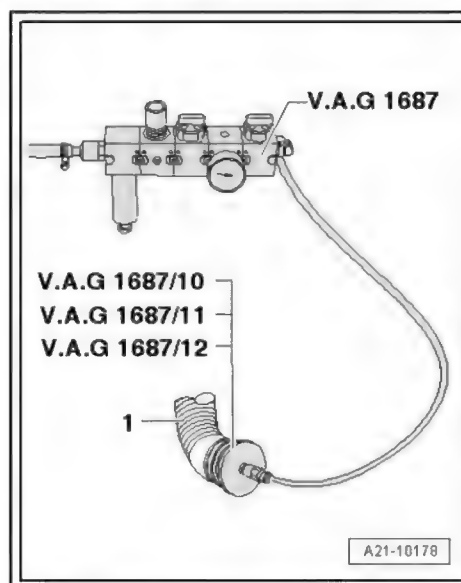
- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .



- Release hose clip -arrow-, disconnect air hose and press to one side.



- Insert adapter - 1687/12- into air hose -1- and secure with hose clip.
- Connect charge air system tester - V.A.G 1687- as shown on illustration.



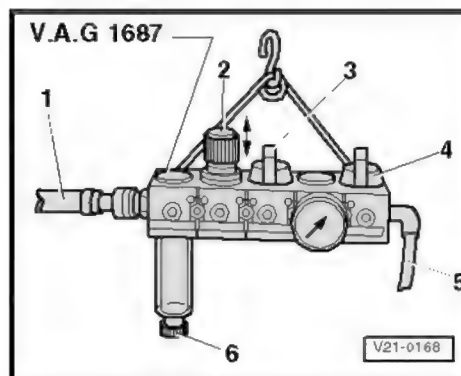
Prepare charge air system tester - V.A.G 1687- as follows:

- Unscrew pressure control valve -2- completely and close valves -3- and -4-.



Note

Make sure knob is pulled out before turning pressure control valve -2-.



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- Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.



Note

If there is water in sight glass, remove drain plug -6- and drain water.

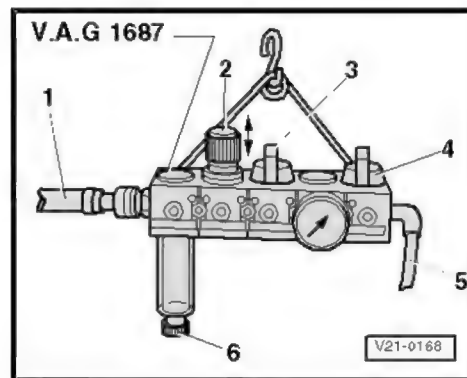
- Open valve -3-.



Caution

Risk of damage if pressure is set too high.

♦ *The pressure must not exceed 0.5 bar.*



- Adjust pressure to 0.5 bar via pressure control valve -2-.
- Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
- Check charge air system for audible leaks or leaks that can be felt with the hand; apply commercially available leak detection spray or use ultrasonic tester - V.A.G 1842- .



Note

- ♦ *A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.*
- ♦ *For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .*
- ♦ *Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.*

Assembling

Installation is carried out in the reverse order; note the following:



Note

Renew gasket and O-rings.

- Install air hoses with screw-type clips
⇒ ["2.2 Exploded view - hose connections for charge air system", page 209 .](#)
- Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



23 – Mixture preparation - injection

1 Injection system

⇒ ["1.1 Overview - fuel system", page 214](#)

⇒ ["1.2 Overview of fitting locations - injection system", page 216](#)

⇒ ["1.3 Filling and bleeding fuel system", page 222](#)

1.1 Overview - fuel system



Caution

The high-pressure pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:

- ◆ *If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled*
⇒ ["1.3 Filling and bleeding fuel system", page 222](#) .
- ◆ *If the high-pressure pump is removed or renewed, the first fuel filling operation must be performed before the engine is started for the first time*
⇒ ["1.3 Filling and bleeding fuel system", page 222](#) .



Note

The high-pressure pump will be damaged if the first fuel filling operation is not performed.

1 - Fuel tank

- ☐ With fuel system pressurisation pump - G6-

2 - Fuel filter

- ☐ Exploded view ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Fuel filter; Exploded view - fuel filter

3 - Not fitted

4 - Filter strainer

5 - Fuel temperature sender - G81-

6 - High-pressure pump

- ☐ After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted using ⇒ Vehicle diagnostic tester

- ☐ Exploded view ⇒ [page 262](#)

7 - Fuel metering valve - N290-

- ☐ Do not unscrew

8 - Fuel pressure regulating valve - N276-

- ☐ Exploded view ⇒ [page 236](#)

9 - Fuel rail

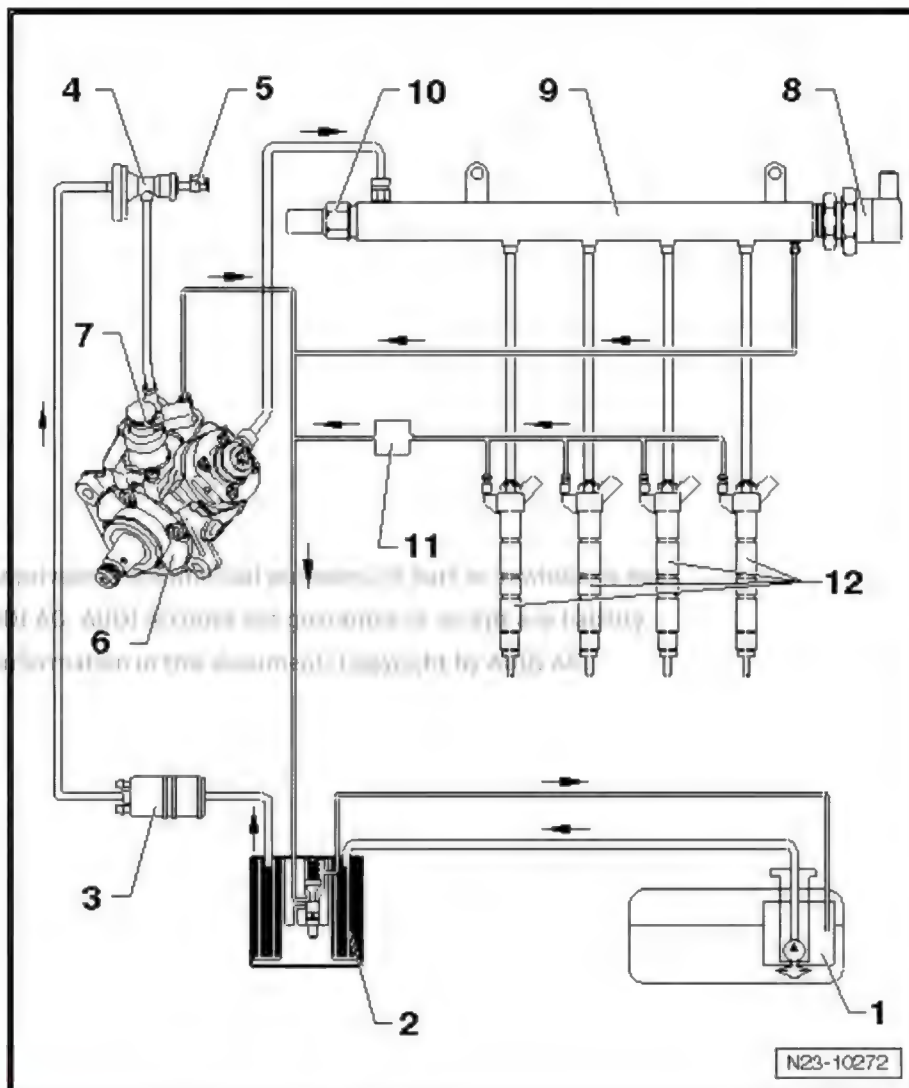
10 - Fuel pressure sender - G247-

- ☐ Exploded view ⇒ [page 236](#)

11 - Restrictor

12 - Injector

- ☐ Exploded view ⇒ [page 236](#)



1.2 Overview of fitting locations - injection system

1 - Air mass meter - G70-

- ☐ Removing and installing
⇒ [page 261](#)

2 - Electrical connectors

- ☐ For Lambda probe - G39-
- ☐ For exhaust gas temperature sender 3 - G495-
- ☐ Fitting location
⇒ [page 220](#)

3 - Lambda probe - G39- with Lambda probe heater - Z19-

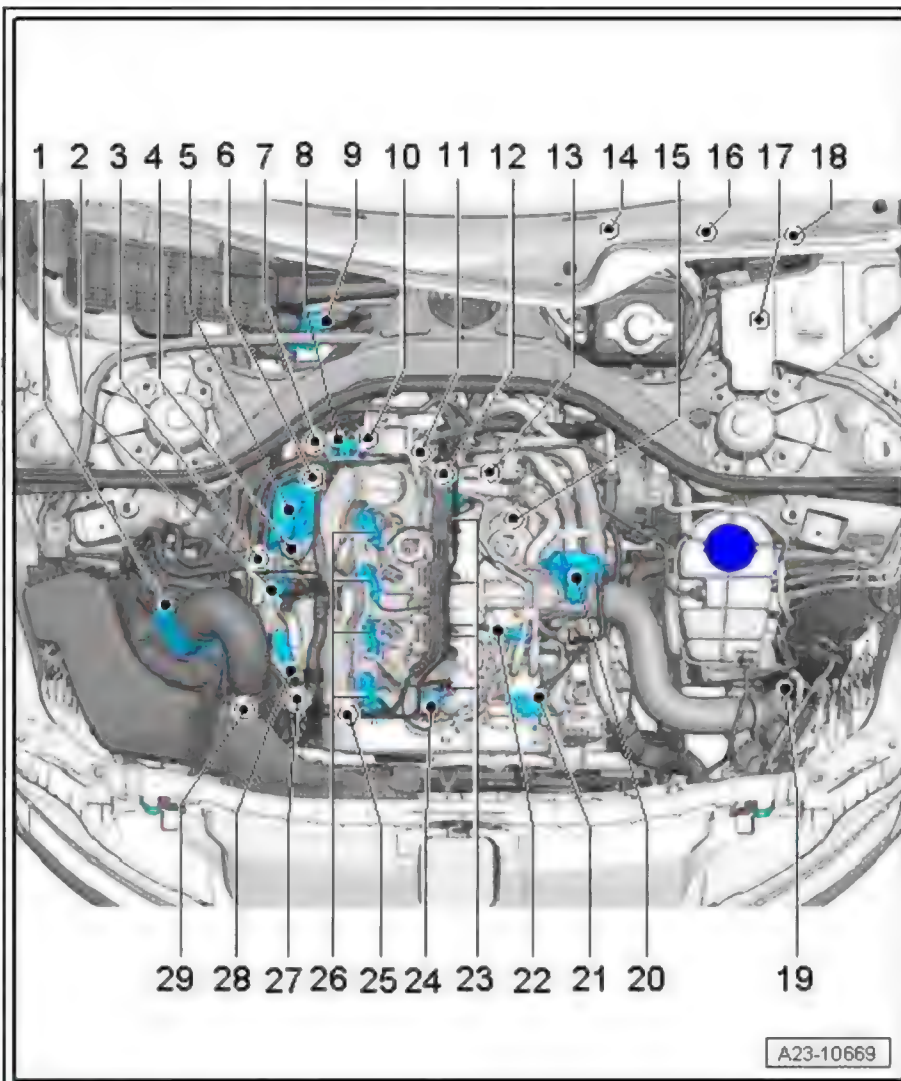
- ☐ Fitting location
⇒ [page 220](#)
- ☐ Exploded view
⇒ [page 266](#)

4 - Exhaust gas temperature sender 1 - G235-

- ☐ Fitting location
⇒ [page 222](#)

5 - Exhaust gas recirculation control motor - V338- with exhaust gas recirculation potentiometer - G212-

- ☐ Integrated into exhaust gas recirculation cooler
- ☐ Checking exhaust gas recirculation cooler change-over
⇒ [page 293](#)
- ☐ Removing and installing exhaust gas recirculation cooler ⇒ [page 291](#)



6 - Exhaust gas temperature sender 3 - G495-

- ☐ Fitting location ⇒ [page 220](#)
- ☐ Exploded view ⇒ [page 266](#)

7 - Radiator outlet coolant temperature sender - G83-

- ☐ Fitting location ⇒ [page 220](#)

8 - Pressure differential sender - G505-

- ☐ Fitting location ⇒ [page 220](#)
- ☐ Exploded view ⇒ [page 266](#)

9 - Coolant circulation pump - V50-

- ☐ Vehicles with start/stop system only
- ☐ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit; Overview of fitting locations - coolant circuit

10 - Exhaust gas temperature sender 4 - G648-

- ☐ Fitting location ⇒ [page 222](#)
- ☐ Exploded view ⇒ [page 266](#)

11 - Coolant temperature sender - G62-

- ☐ Fitting location ⇒ [page 219](#)



12 - Fuel pressure regulating valve - N276-

- ☐ Fitting location ⇒ [page 219](#)
- ☐ Removing and installing ⇒ [page 255](#)

13 - Engine speed sender - G28-

- ☐ Fitting location ⇒ [page 221](#)
- ☐ Exploded view ⇒ [page 305](#)

14 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ☐ Fitting location ⇒ [page 218](#)

15 - Pump for exhaust gas recirculation cooler - V400-

- ☐ Fitting location ⇒ [page 219](#)

16 - Brake light switch - F-

- ☐ Fitting location ⇒ [page 218](#)

17 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 218](#)

18 - Clutch position sender - G476-

- ☐ With clutch pedal switch for engine start - F194- and clutch pedal switch - F36-
- ☐ Only on vehicles with manual gearbox
- ☐ Fitting location ⇒ [page 218](#)

19 - Charge pressure sender - G31- / intake air temperature sender - G42-

- ☐ Fitting location ⇒ [page 221](#)

20 - Throttle valve module - J338- with throttle valve potentiometer - G69-

- ☐ Exploded view ⇒ [page 229](#)

21 - Fuel metering valve - N290-

- ☐ Fitting location ⇒ [page 219](#)
- ☐ Removing and installing ⇒ [page 263](#)

22 - Fuel temperature sender - G81-

- ☐ Fitting location ⇒ [page 219](#)

23 - Glow plugs

- ☐ Glow plug 1 - Q10-
- ☐ Glow plug 2 - Q11-
- ☐ Glow plug 3 - Q12-
- ☐ Glow plug 4 - Q13-
- ☐ Removing and installing ⇒ [page 305](#)

24 - Fuel pressure sender - G247-

- ☐ Fitting location ⇒ [page 219](#)
- ☐ Removing and installing ⇒ [page 258](#)

25 - Hall sender - G40-

- ☐ Fitting location ⇒ [page 220](#)
- ☐ Removing and installing ⇒ [page 307](#)

26 - Injectors

- ☐ Injector, cylinder 1 - N30-
- ☐ Injector, cylinder 2 - N31-
- ☐ Injector, cylinder 3 - N32-
- ☐ Injector, cylinder 4 - N33-
- ☐ Removing and installing ⇒ [page 246](#)



27 - Charge pressure control solenoid valve - N75-

- ❑ Fitting location ⇒ [page 221](#)

28 - Position sender for charge pressure positioner - G581-

- ❑ Fitting location ⇒ [page 221](#)

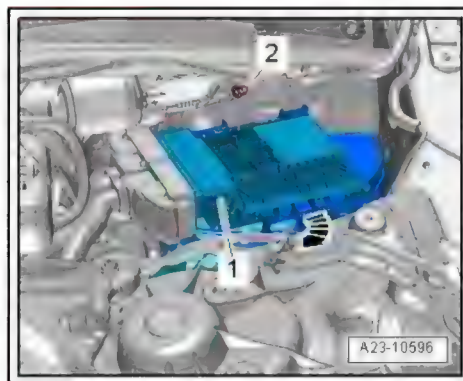
29 - Exhaust gas recirculation cooler change-over valve - N345-

- ❑ Electrical connector for exhaust gas temperature sender 1 - G235-
- ❑ Fitting location ⇒ [page 222](#)
- ❑ Removing and installing exhaust gas recirculation cooler ⇒ [page 291](#)

Fitting location of engine control unit - J623-

- ◆ In electronics box in plenum chamber (left-side)

Removing and installing ⇒ [page 269](#)



Fitting location: accelerator position sender - G79- and accelerator position sender 2 - G185-

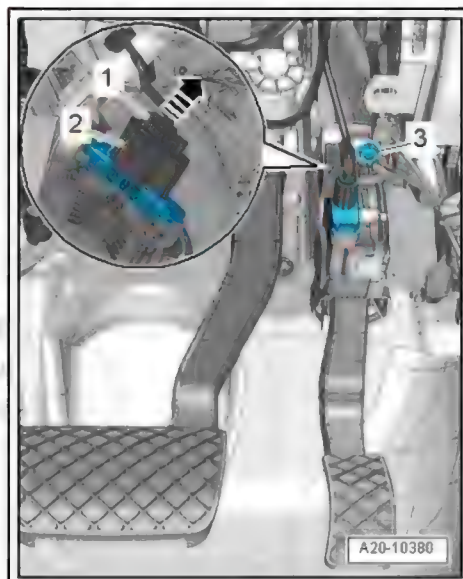
- ◆ In accelerator pedal module



Note

The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

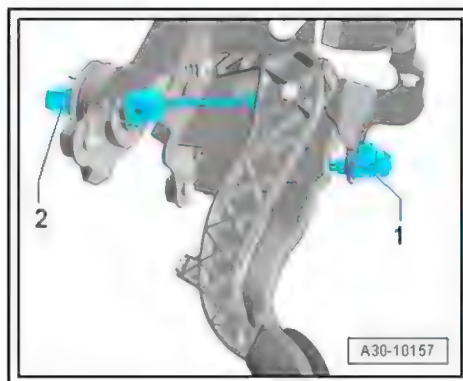
Removing and installing ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79-/G185- .



Fitting location of brake light switch - F- / clutch position sender - G476-

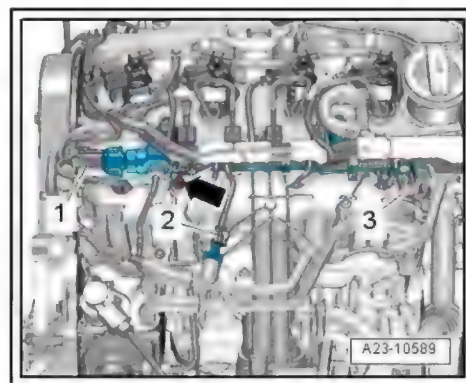
- 1 - Brake light switch - F-
- 2 - Clutch position sender - G476- with clutch pedal switch for engine start - F194- and clutch pedal switch - F36- (manual gearbox only)

Removing and installing ⇒ Brake system; Rep. gr. 45 ; Sensors; Removing and installing brake light switch

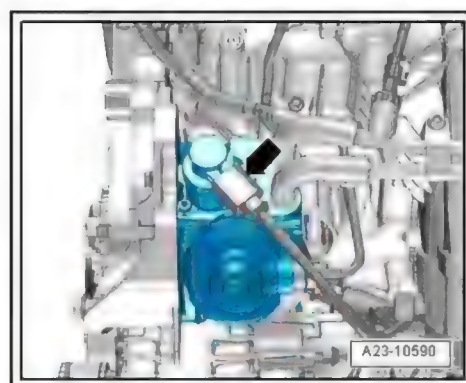


Fitting locations

- 1 - Fuel pressure sender - G247-
- 2 - Fuel temperature sender - G81-
- 3 - Fuel pressure regulating valve - N276-



Fuel metering valve - N290- -arrow-

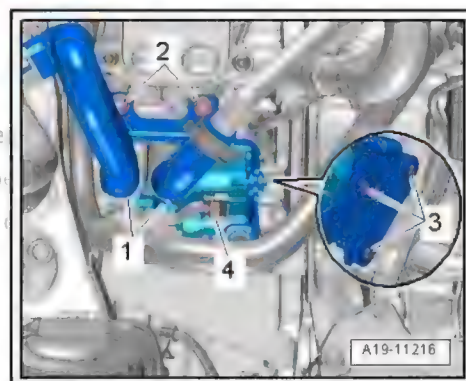


Fitting location of pump for exhaust gas recirculation cooler - V400-

4 - Electrical connector for pump for exhaust gas recirculation cooler - -

◆ At rear left of engine

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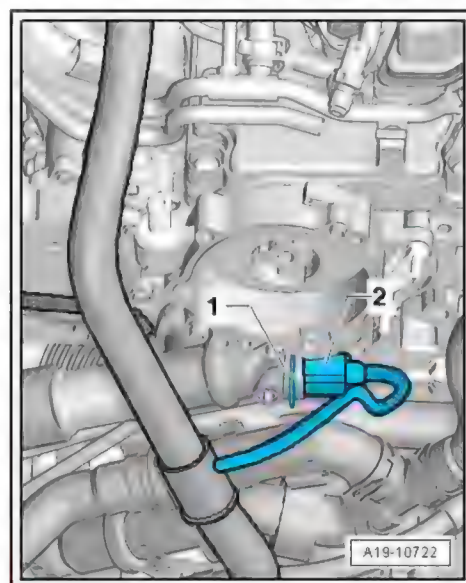


Fitting location of coolant temperature sender - G62-

2 - Electrical connector for coolant temperature sender - G62-

◆ At rear of engine

Removing and installing ⇒ [page 176](#)

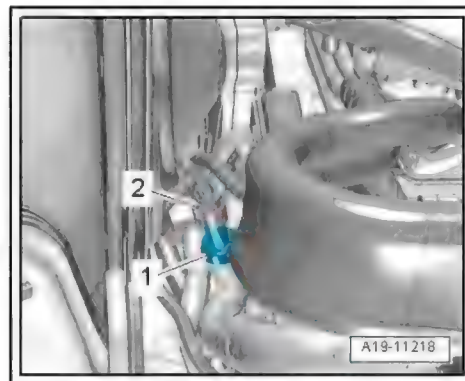




Fitting location of radiator outlet coolant temperature sender - G83-

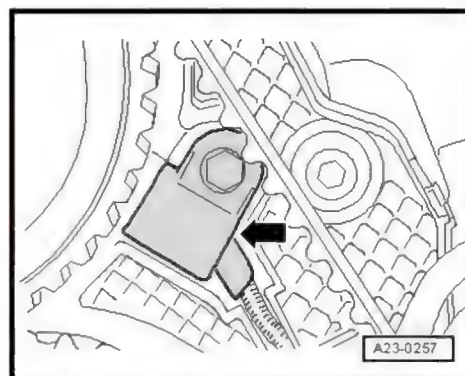
- ◆ -Item 1- in coolant pipe (rear)

Removing and installing ➔ [page 177](#)



Fitting location of Hall sender - G40-

- ◆ At front of engine next to camshaft sprocket -arrow-



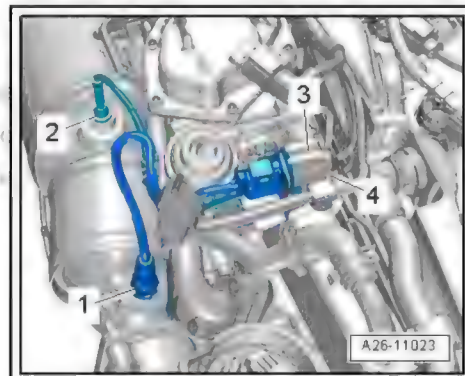
Fitting locations

1 - Lambda probe - G39-

2 - Exhaust gas temperature sender 3 - G495-

3 - Electrical connector for Lambda probe - G39-

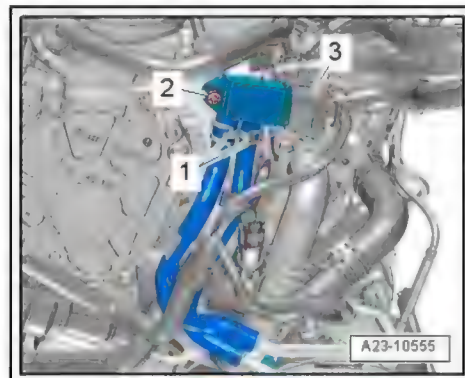
4 - Electrical connector for exhaust gas temperature sender 3 - G495-



Fitting location of pressure differential sender - G505-

3 - Electrical connector for pressure differential sender - G505-

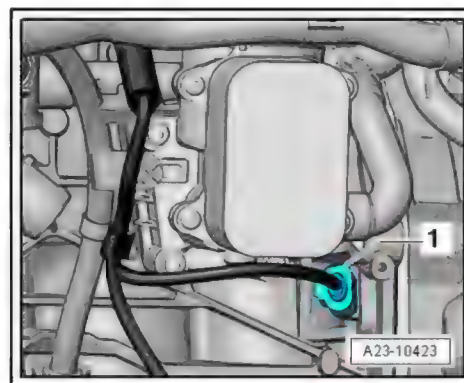
- ◆ At rear of engine





Fitting location of engine speed sender - G28-

- 1 - Electrical connector for engine speed sender - G28-



Fitting location of charge pressure sender - G31- with intake air temperature sender - G42-

- 1 - Electrical connector for charge pressure sender - G31- with intake air temperature sender - G42-

◆ In engine compartment (front left)

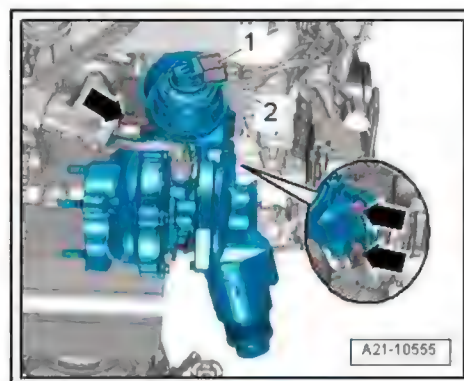
Removing and installing ⇒ [page 211](#)



Fitting location of position sender for charge pressure positioner - G581-

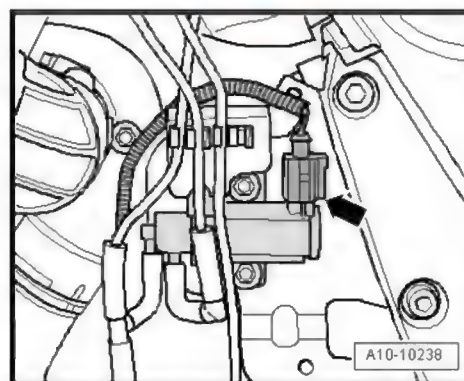
- 1 - Electrical connector for position sender for charge pressure positioner - G581-

◆ On turbocharger on right side of engine



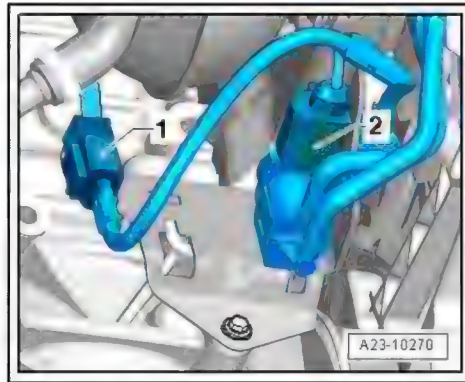
Fitting location of charge pressure control solenoid valve - N75-

◆ At front right of engine -arrow-

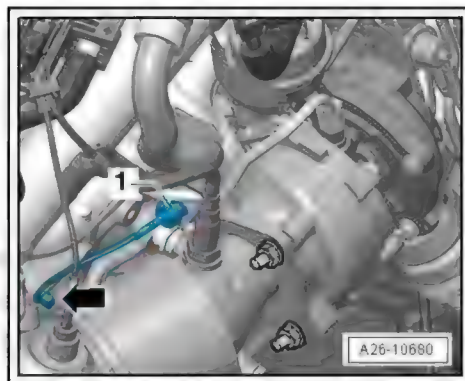


Electrical connectors

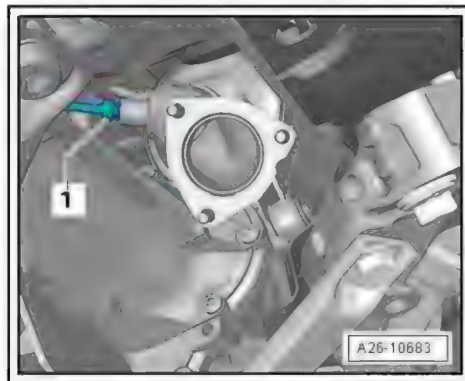
- 1 - Exhaust gas temperature sender 1 - G235-
2 - Exhaust gas recirculation cooler change-over valve - N345-



Exhaust gas temperature sender 1 - G235- -1-



Exhaust gas temperature sender 4 - G648- -1-



1.3 Filling and bleeding fuel system

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled.

Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

- Never allow fuel pump to run while it is empty.
- Fill/bleed fuel pump.



Proceed as follows to fill high-pressure pump with fuel.

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.
- Connect ➔ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Drive train**
 - ◆ **Select engine code and engine**
 - ◆ **01 - Self-diagnosis compatible systems**
 - ◆ **01 - Engine electronics**
 - ◆ **01 - Engine electronics, functions**
 - ◆ **Activate fuel pump**
 - ◆ Press **Carry out check**
 - ◆ Select 120 seconds.
- The fuel pump must run for 120 seconds to ensure that the fuel system is filled sufficiently with fuel.
- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section again for leaks.

1.4 Checking fuel system for leaks

- Allow engine to run for several minutes at moderate rpm.
- Switch off ignition.
- Check complete fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section of fuel system again for leaks.



2

⇒ "2.1 Connection diagram - vacuum system", page 224

⇒ "2.2 Checking vacuum system", page 224

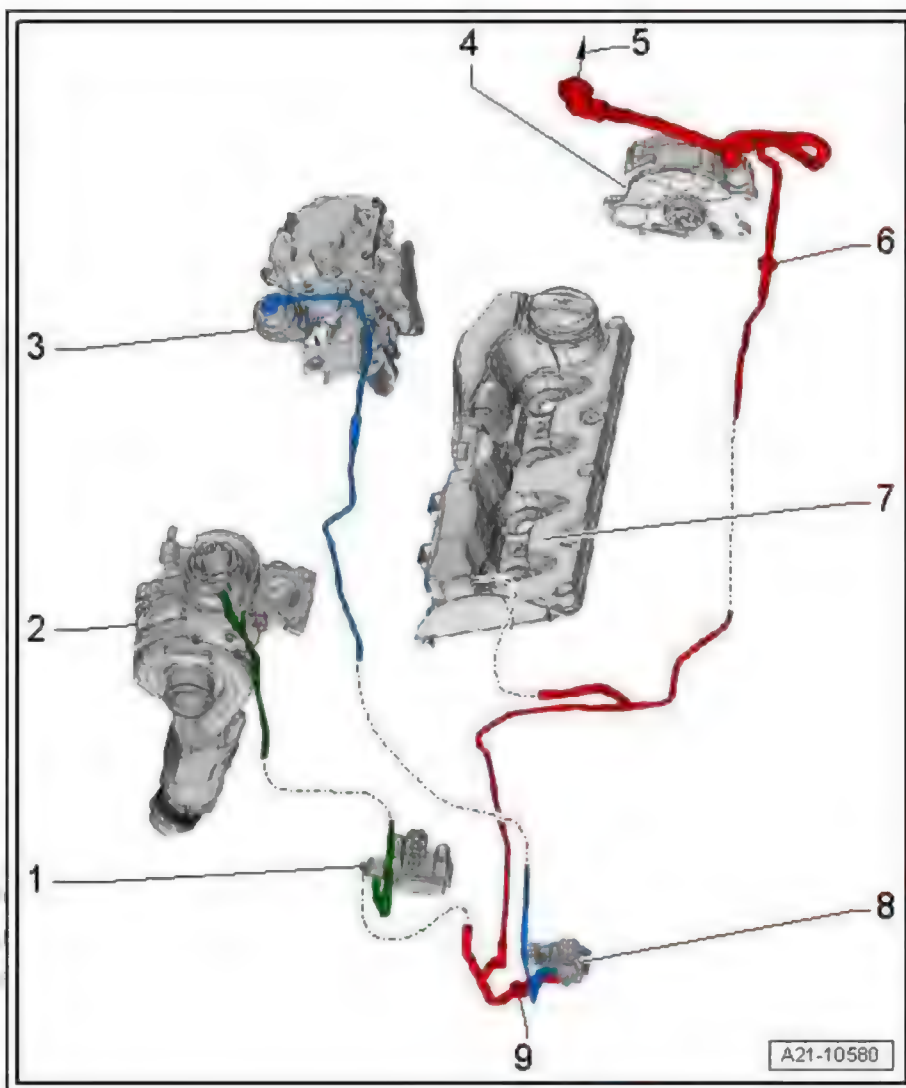
2.1



Risk of engine malfunctions

- ◆ *When routing vacuum lines, make sure they are not kinked, twisted or crushed.*

- 1 - Charge pressure control solenoid valve - N75-
- 2 - Turbocharger with vacuum unit
 - ☐ With position sender for charge pressure positioner - G581-
- 3 - Vacuum unit
 - ☐ For change-over function for exhaust gas recirculation cooler
- 4 - Vacuum pump
- 5 - To brake servo
- 6 - Non-return valve
 - ☐ Note installation position
- 7 - Cylinder head cover
 - ☐ With vacuum reservoir
- 8 - Exhaust gas recirculation cooler change-over valve - N345-
- 9 - Non-return valve
 - ☐ Note installation position



2.2

Special tools and workshop equipment required



◆ Hand vacuum pump - VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Porous or leaking lines
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If a fault is stored in the event memory, check the vacuum lines leading to the relevant component and also check the remaining vacuum lines in the system.
- If it is not possible to build up a vacuum with the hand vacuum pump - VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.



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3 Air cleaner

⇒ "3.1 Exploded view - air cleaner housing", page 226

⇒ "3.2 Removing and installing air cleaner housing", page 227

3.1 Exploded view - air cleaner housing

1 - Air duct

- ☐ Clean out salt deposits, dirt and leaves, etc.

2 - Sealing element

3 - Mounting

- ☐ For air cleaner housing

4 - Air cleaner housing

- ☐ Clean out salt deposits, dirt and leaves, etc.
- ☐ Removing and installing
⇒ [page 227](#)

5 - Air filter element

- ☐ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing
⇒ Maintenance ; Booklet 411

6 - Cover

- ☐ For air cleaner housing
- ☐ Remove any salt deposits or dirt

7 - Housing for air mass meter - G70-

8 - Bolt

9 - Air mass meter - G70-

10 - Air duct

- ☐ Clean out salt deposits, dirt and leaves, etc.

11 - Air pipe

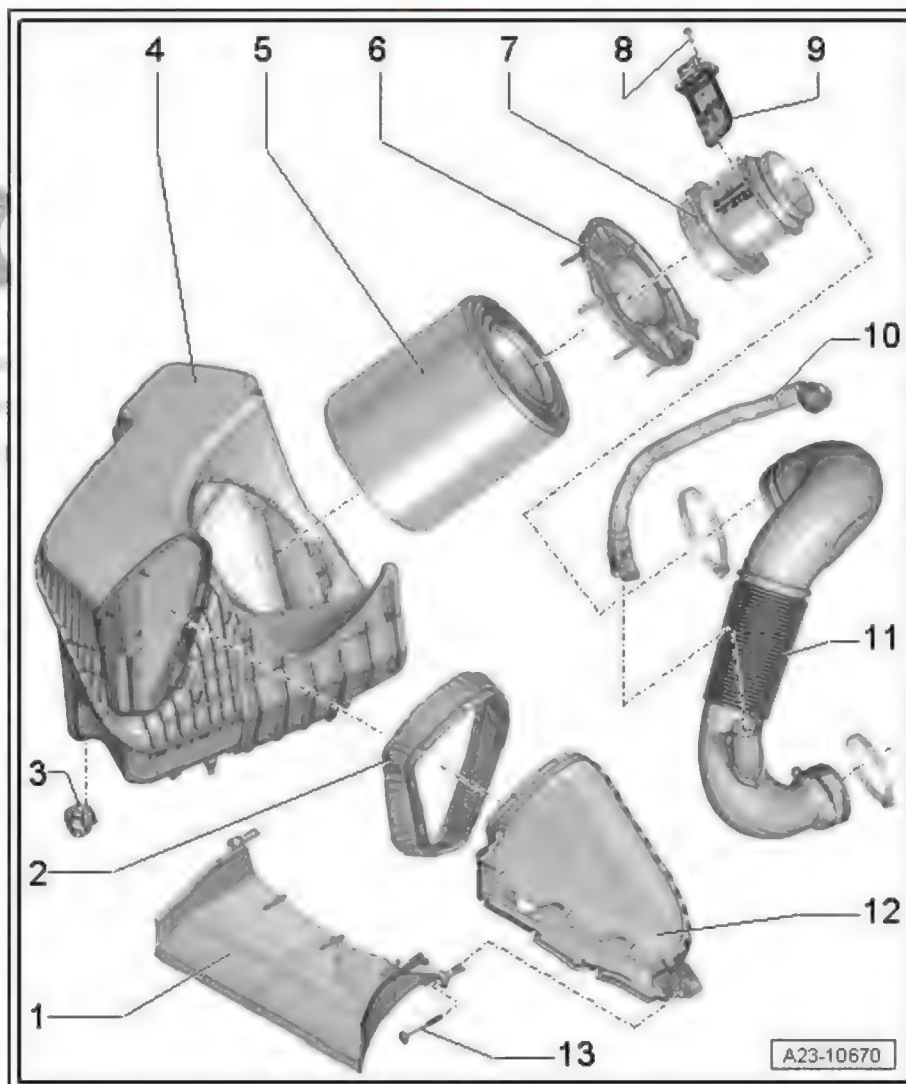
- ☐ Tightening torque for screw-type clips ⇒ [page 209](#)

12 - Air duct

- ☐ Clean out salt deposits, dirt and leaves, etc.

13 - Bolt

- ☐ 1.5 Nm





3.2 Removing and installing air cleaner housing

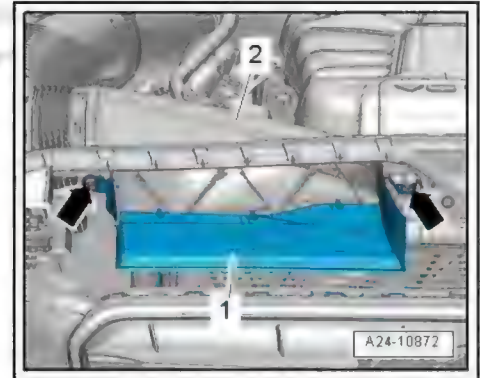
Removing

- Remove lock carrier cover ⇒ General body repairs, exterior;
Rep. gr. 63 ; Bumper (front); Removing and installing attachments
- Remove bolts -arrows- and detach air duct -2-



Note

Disregard -item 1-





- Unplug electrical connector -2- at air mass meter - G70- .
- Open hose clip -3- on air hose and disconnect hose at air mass meter - G70- .
- Lift out air cleaner housing -1-.

Installing

To ensure the proper function of the air mass meter - G70- it is important to observe the following instructions.

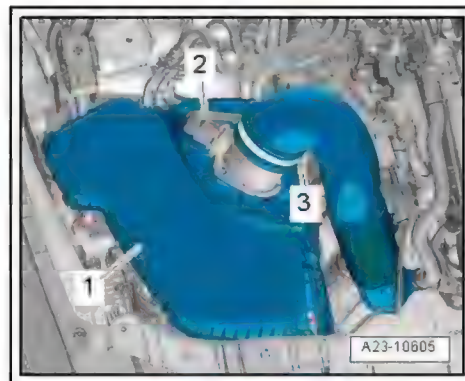


Note

- ◆ *The air cleaner housing must always be clean.*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.*
- ◆ *Use a lubricant (silicone-free) when installing air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Check water drain hose in air cleaner (bottom section) for dirt and other obstructions (clean if necessary).
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); use a vacuum cleaner if necessary.
- Check for salt residue, dirt and leaves in air hose (engine intake side).
- Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.
- Re-install air cleaner housing.
- Make sure that air hose is correctly seated at air mass meter - G70- .

The remaining installation steps are carried out in the reverse sequence.

- Install lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .





4 Intake manifold

⇒ "4.1 Exploded view - intake manifold", page 229

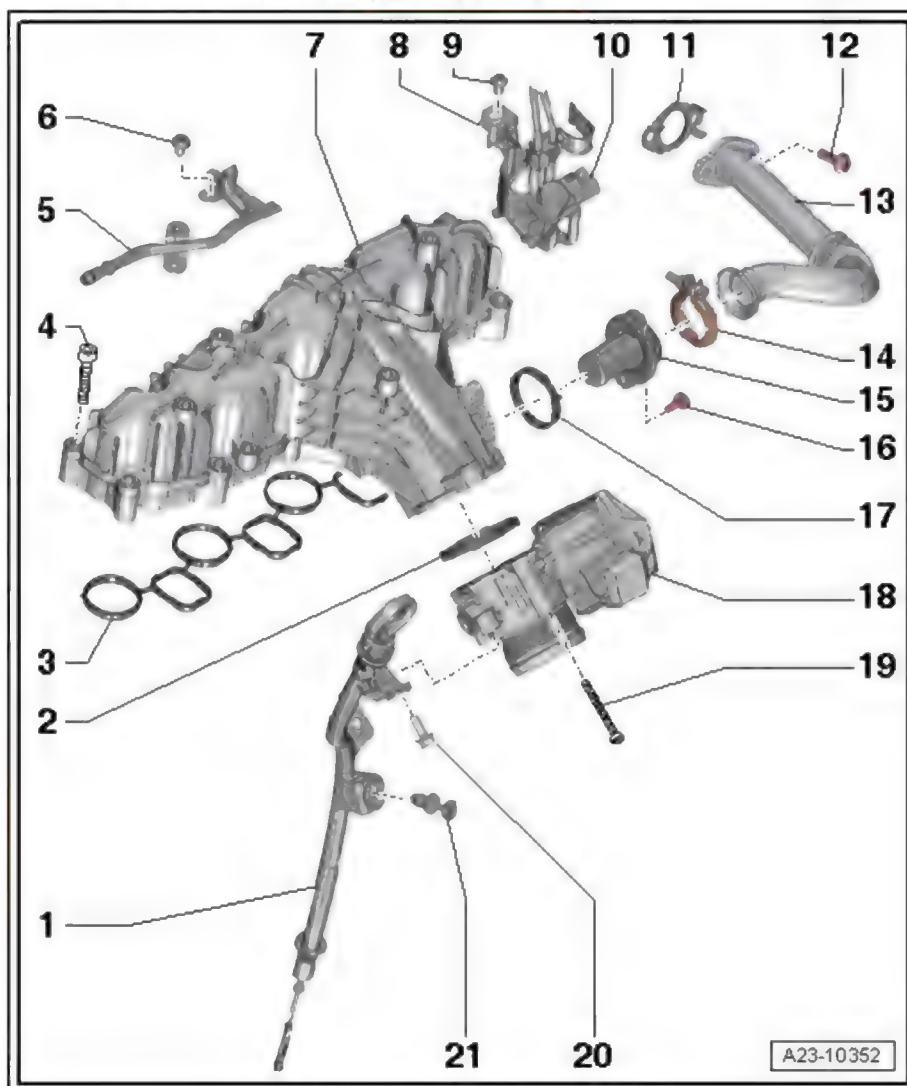
⇒ "4.2 Removing and installing intake manifold", page 230

⇒ "4.3 Removing and installing throttle valve module J338", page 233

⇒ "4.4 Cleaning throttle valve module J338", page 233

4.1 Exploded view - intake manifold

- 1 - Guide tube
☐ For oil dipstick
- 2 - Seal
☐ Renew
- 3 - Gasket
☐ Renew
- 4 - Bolt
☐ 8 Nm
- 5 - Fuel return line
☐ Version fitted in vehicle may differ from illustration
- 6 - Bolt
☐ 9 Nm
- 7 - Intake manifold
☐ Removing and installing
⇒ [page 230](#)
- 8 - Not fitted
- 9 - Not fitted
- 10 - Not fitted
- 11 - Gasket
☐ Renew
- 12 - Bolt
☐ 9 Nm
- 13 - Connecting pipe
☐ To exhaust gas recirculation cooler
- 14 - Clamp
☐ Renew
☐ 5 Nm
- 15 - Pipe connection
☐ For exhaust gas recirculation
☐ Opening must face cylinder head when installing; it may be necessary to rework pipe connection
⇒ [page 230](#)
- 16 - Bolt
☐ 9 Nm
- 17 - Seal
☐ Renew





18 - Throttle valve module - J338-

- ☐ With throttle valve potentiometer - G69-
- ☐ Cleaning ⇒ ["4.4 Cleaning throttle valve module J338", page 233](#)
- ☐ Removing and installing ⇒ ["4.3 Removing and installing throttle valve module J338", page 233](#)

19 - Bolt

- ☐ 8 Nm

20 - Bolt

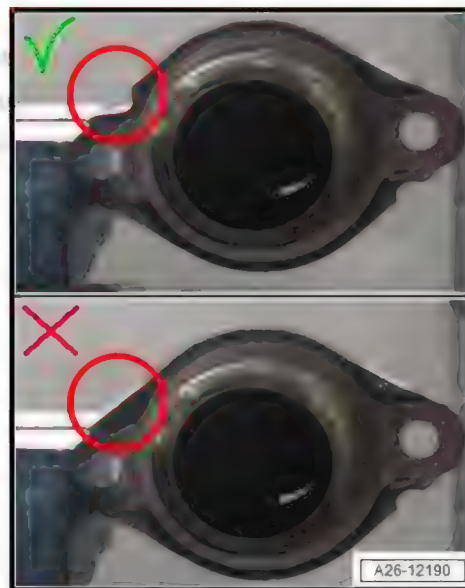
- ☐ 9 Nm

21 - Clip



Pipe connection must be installed rotated through 180°. Opening of pipe connection faces cylinder head.

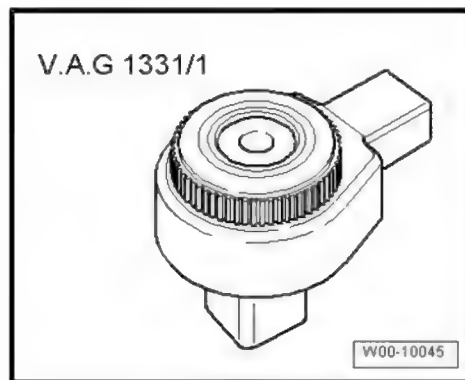
- Using a suitable file, create a new recess opposite existing recess in support plate of pipe connection.



4.2 Removing and installing intake manifold

Special tools and workshop equipment required

- ♦ Ratchet - V.A.G 1331/1-



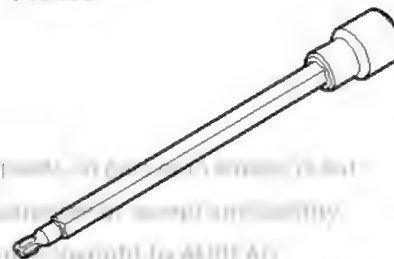


◆ Socket Torx T30 - T10405-



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T10405



W00-10757

◆ Socket - T40055-

T40055



W00-11197

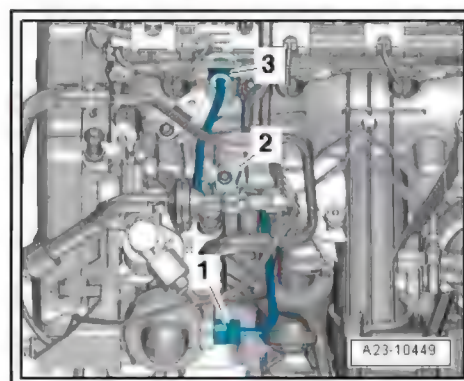
Removing



Caution

- ◆ Observe ⇒ ["3.1 Rules for cleanliness", page 5](#).
- ◆ Risk of malfunctions caused by dirt.

- Remove engine cover panel ⇒ [page 41](#).
- Unplug electrical connectors on glow plugs ⇒ [page 305](#).
- Remove bolt -2- and union nuts -1 and 3- and detach high-pressure pipe.

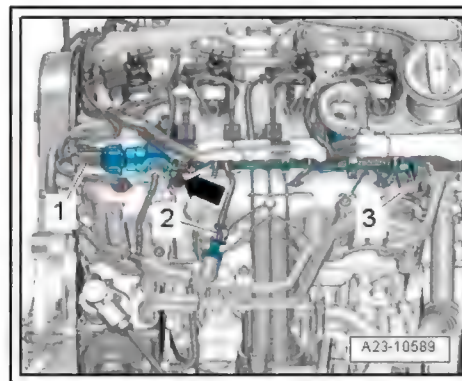


A23-10449

- Unplug electrical connectors -2 and 3-.
- Remove bolt -arrow- and push wiring retainer to the side.



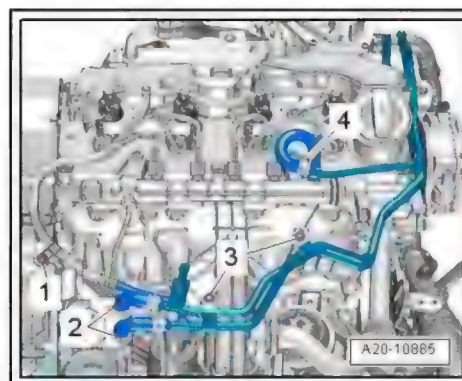
Disregard -item 1-.



- Remove bolts -1 and 3-.
- Release hose clips -2 and 4- and detach fuel hoses.
- Pull fuel lines upwards off cylinder head cover and press clear to one side.



Do not bend fuel lines.



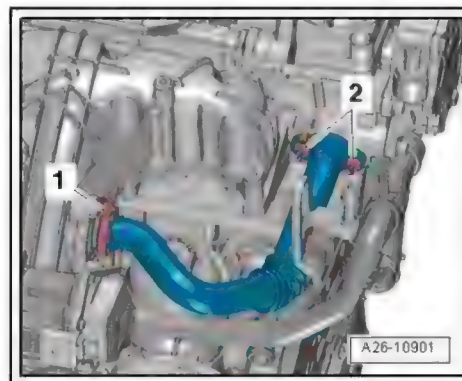
Caution

- ♦ Observe rules for cleanliness when working on the injection system.
- ♦ Plug open connections with suitable sealing caps immediately.

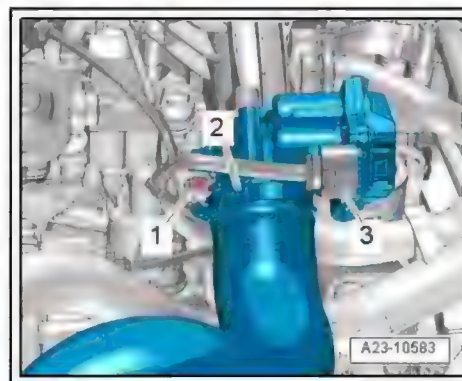
- Open clamp -1- and detach.



Disregard -item 2-.



- Release hose clip -2- and detach air hose.
- Remove bolt -1- for dipstick guide tube.
- Unplug electrical connector -3- at throttle valve module - J338- .



- Unscrew intake manifold bolts -arrows- in diagonal sequence starting from outside and working inwards using socket Torx T30 - T10405- .

Installing

Installation is carried out in reverse order; note the following:



Note

Renew seals and/or gaskets.

- Tighten intake manifold bolts in diagonal sequence, working from inside to outside.
- Install high-pressure pipe ➔ [page 250](#) .

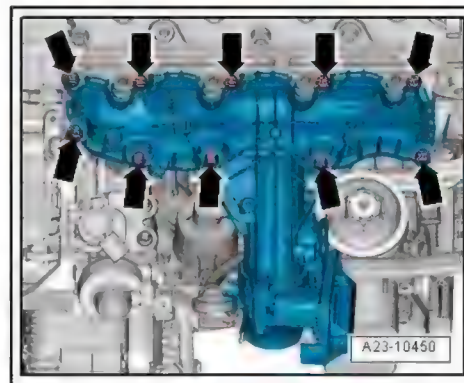
Tightening torques

- ◆ ➔ ["4.1 Exploded view - intake manifold", page 229](#)

4.3 Removing and installing throttle valve module - J338-

Removing

- Remove engine cover panel ➔ [page 41](#) .
- Release hose clip -arrow- and detach air hose downwards.



- Unplug electrical connector -2-.
- Remove bolt -1- for dipstick guide tube.
- Remove bolts -arrows- and detach throttle valve module - J338- .

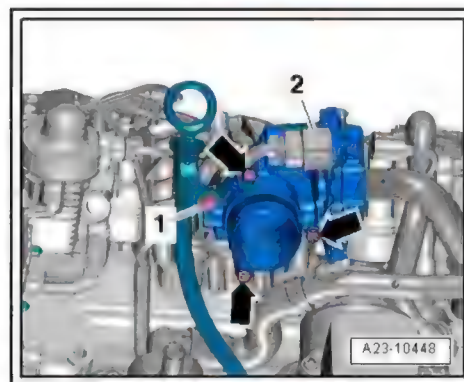
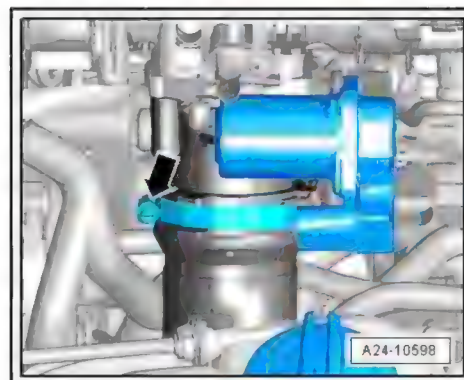
Installing

Installation is carried out in reverse order; note the following:



Note

Fit new O-ring.



Tightening torques

- ◆ ➔ ["4.1 Exploded view - intake manifold", page 229](#)

4.4 Cleaning throttle valve module - J338-

Special tools and workshop equipment required

- ◆ Acetone (commercially available)
- ◆ Safety goggles
- ◆ Protective gloves

- ◆ Ultrasonic cleaning unit - VAS 6418-
- ◆ Cleaning solution -D 600 200 A2- : refer to ⇒ ETKA

Procedure

- Remove throttle valve module - J338-
⇒ ["4.3 Removing and installing throttle valve module J338"](#),
[page 233](#) .

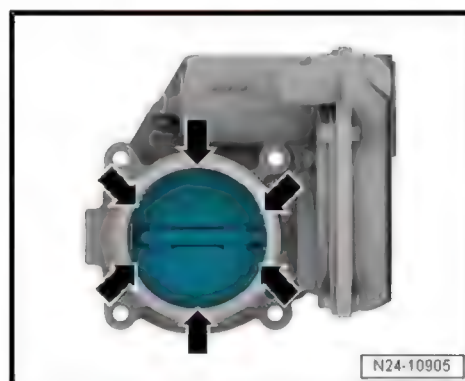


WARNING

Risk of injury caused by acetone. Acetone is highly flammable and can cause irritation to the eyes and skin.

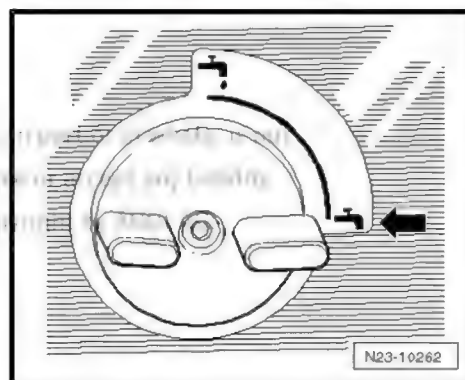
- ◆ Put on safety goggles.
- ◆ Put on protective gloves.

- Pre-clean throttle valve housing, especially around throttle valve -arrows-, using commercially available acetone and a plastic scraper.
- Take care not to scratch the throttle valve housing when cleaning it.

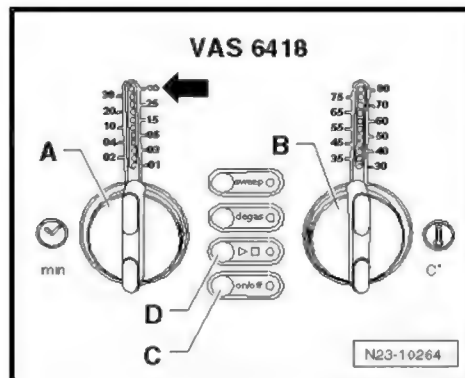


Cleaning throttle valve module - J338- using ultrasonic cleaning unit - VAS 6418-

- Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).
- Fill ultrasonic cleaning unit - VAS 6418- with approx. 1800 ml of hot tap water and 200 ml of cleaning solution -D 600 200 A2-.



- Switch on cleaning unit by pressing **[on/off]** button -C-.
- Turn rotary temperature control -B- until LED for heating temperature is at 60 °C.
- Turn rotary control for operating time -A- to -arrow- (continuous operation).
- Press **[▶]** -D- button to start unit running.





- Immerse throttle valve module -1- until only throttle valve is covered by cleaning fluid and fix in position using workshop materials.
- The electronics must not come into contact with the cleaning fluid.
- Once ultrasonic cleaning unit - VAS 6418- has reached 60 °C, clean throttle valve module for approx. 30 minutes on continuous ultrasonic cleaning setting.
- Remove softened remaining deposits with a brush or cloth.
- There must not be any moisture in connector (blow out with compressed air if necessary).
- Before installing throttle valve module, check it is functioning properly; to do so connect electrical connector to throttle valve module.
- Start engine briefly and then turn it off again immediately. If throttle valve closes and opens after switching off engine, throttle valve module is functioning properly.
- If throttle valve module is OK, install throttle valve module
⇒ "4.3 Removing and installing throttle valve module J338 "
page 233 .





5 Injectors/high-pressure reservoir (rail)

- ⇒ ["5.1 Exploded view - injectors", page 236](#)
- ⇒ ["5.2 Performing adaption of correction values for injectors", page 239](#)
- ⇒ ["5.3 Checking injectors", page 239](#)
- ⇒ ["5.4 Checking return flow rate of injectors with engine running", page 240](#)
- ⇒ ["5.5 Checking return flow rate of injectors at starter cranking speed", page 243](#)
- ⇒ ["5.6 Checking for injectors sticking open", page 244](#)
- ⇒ ["5.7 Removing and installing injectors", page 246](#)
- ⇒ ["5.8 Removing and installing high-pressure pipes", page 250](#)
- ⇒ ["5.9 Removing and installing high-pressure reservoir \(rail\)", page 251](#)

5.1 Exploded view - injectors

When installing a new base engine, you must check whether there is a sticker on the cylinder head cover.

If a sticker is attached which states **Spannpratzen auf vorgeschriebenes Drehmoment angezogen** (clamping pieces tightened to specified torque), the clamping pieces have already been tightened to the specified final torque at the factory.

If no sticker is attached, it is essential that the clamping pieces for the injectors are tightened to the specified torque ⇒ [Item 7 \(page 237\)](#) after installing the high-pressure pipes. If these instructions are not observed, the engine could be damaged.



1 - Seal

- ☐ In cylinder head cover
- ☐ Renew if leaking
⇒ [page 110](#)

2 - Copper seal

- ☐ Always renew copper seal when removing and installing

3 - O-ring

- ☐ Renew

4 - Injector

- ☐ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ☐ Always renew copper seal when removing and installing
- ☐ To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- ☐ Removing and installing
⇒ [page 246](#)

5 - O-ring

- ☐ Renew

6 - Fuel return line

- ☐ To fuel tank
- ☐ With restrictor
- ☐ Must not be kinked, damaged or clogged
- ☐ Do not dismantle
- ☐ The restrictor maintains a constant residual pressure in the fuel return lines
- ☐ This residual pressure is required for the control function of the injectors
- ☐ After replacement, engine must be run at idling speed for approx. 2 minutes to bleed fuel system; then check fuel return line for leaks

7 - Bolt

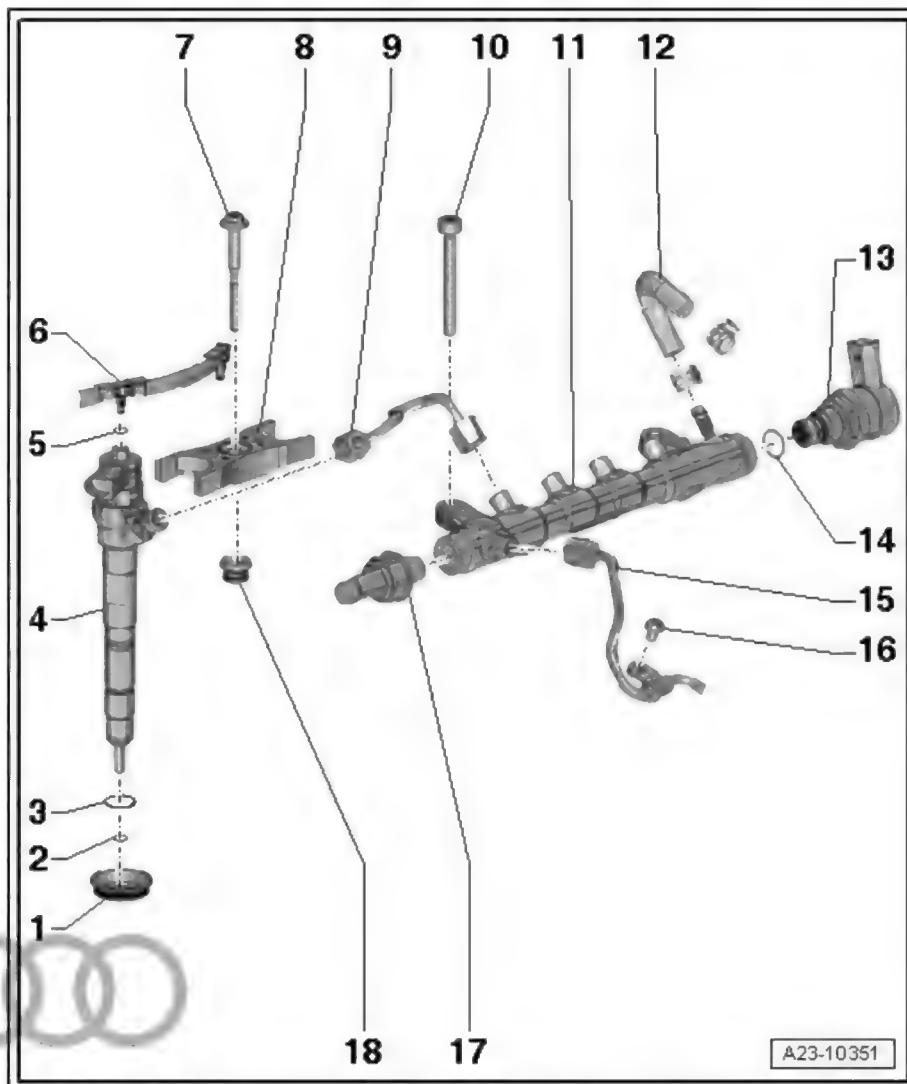
- ☐ Renew
- ☐ Tighten initially to 2 Nm, then screw on union nuts for high-pressure pipes hand-tight and align injectors
- ☐ 8 Nm + 270° (3x 90° further)

8 - Clamping piece

- ☐ Use a coloured pen to mark injectors and corresponding clamping piece and cylinder for re-installation; pay attention to markings when installing
- ☐ The clamping pieces can be re-used when installing new injectors
- ☐ Installation position ⇒ [page 239](#)

9 - High-pressure pipe

- ☐ Between fuel rail and injectors





Note

- ◆ *The high-pressure pipe can be re-used after performing the following checks:*
- ◆ *Check taper seat for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*

- ☐ Install free of stress
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

10 - Bolt

- ☐ 22 Nm

11 - Fuel rail

- ☐ Removing and installing ⇒ [page 251](#)

12 - Fuel return hose

13 - Fuel pressure regulating valve - N276-

- ☐ Always renew after removing
- ☐ Checking ⇒ ["6.2 Checking fuel pressure regulating valve N276 ", page 257](#)
- ☐ Removing and installing
⇒ ["6.1 Removing and installing fuel pressure regulating valve N276 ", page 255](#)
- ☐ 80 Nm
- ☐ After renewing high-pressure pump or fuel pressure regulating valve - N276-, learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester

14 - O-ring

- ☐ Renew

15 - High-pressure pipe

- ☐ Between high-pressure pump and fuel rail



Note

- ◆ *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- ◆ *The high-pressure pipes can be re-used after performing the following checks:*
- ◆ *Check taper seats of high-pressure pipes for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*

- ☐ Install free of stress
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm



16 - Bolt

- ☐ 8 Nm

17 - Fuel pressure sender - G247-

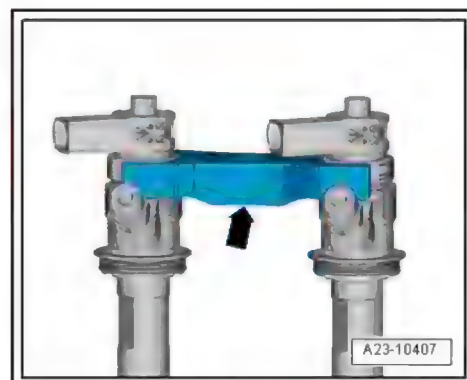
- ☐ Always renew after removing
- ☐ Removing and installing ⇒ [page 258](#)
- ☐ 100 Nm

18 - Grommet

- ☐ In cylinder head cover

Installation position of clamping piece

- Each clamping piece secures two injectors.
- The bulge -arrow- of the clamping piece should point downwards.



5.2 Performing adaption of correction values for injectors

The "Injector delivery calibration values" function serves to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.

The 7-digit adaption values -1- (details in illustration are only an example) are marked separately on each injector. The values may consist of letters and/or numbers.

Injector (view from above)

- 1 - Adaption value (checksum)
- 2 - Data matrix code
- 3 - Part number

When a new injector is installed, the adaption value must be written into the engine control unit.

When a new engine control unit is installed, the "Adaption values for injectors" must be written into the new control unit.

Additionally, check that the "injector delivery calibration values" are correctly entered for all the other injectors. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.

The adaption procedure is described in the Guided Fault Finding (and in the Guided Functions). Use ⇒ Vehicle diagnostic tester



5.3 Checking injectors

There are four different tests for checking the operation of the injectors.

- Checking adaption of "Injector delivery calibration values" and "Injector voltage calibration values" ⇒ [page 239](#)
- Checking for injectors sticking open ⇒ [page 244](#)



- Checking return flow rate of injectors with engine running
⇒ [page 240](#)
- Checking return flow rate of injectors at starter cranking speed
⇒ [page 243](#)

Perform the following tests first if the engine does not start at all:

- ◆ Checking for injectors sticking open ⇒ [page 244](#)
- ◆ Checking return flow rate of injectors at starter cranking speed
⇒ [page 243](#)
- ◆ Checking fuel pressure regulating valve - N276- ⇒ [page 257](#)

5.4 Checking return flow rate of injectors with engine running

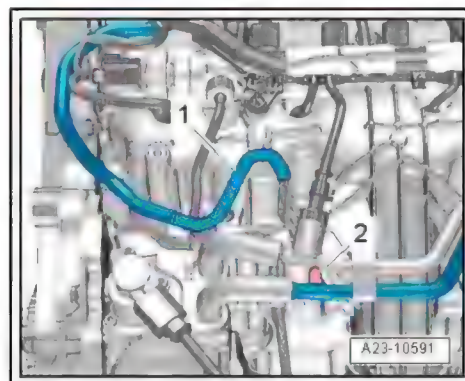
Checking return flow rate of all injectors



Caution

- ◆ Observe ⇒ ["3.1 Rules for cleanliness", page 5](#).
- ◆ Risk of malfunctions caused by dirt.

- Remove engine cover panel ⇒ [page 41](#).
- Disconnect hose connection at fuel line.
- Seal off open return line connection with a clean plug -2-.
- Hold end of fuel return hose -1- (lengthen if necessary) in a measuring container to measure the total return flow rate.
- Start engine and let it idle for 2 minutes.
- Specification for 2 minutes: 0 ml to 50 ml
- If specification is attained, increase engine speed to 2000 ... 2500 rpm for approx. 2 minutes and then check return flow rate again.
- Specification for 2 minutes: less than 250 ml



Note

1000 ml = 1 litre

If specification is exceeded, this indicates that one or more injectors are defective. Check return flow rate from each injector individually.

Checking return flow rate of individual injectors

Special tools and workshop equipment required

Prepared by: [illegible] ...
Approved by: [illegible] ...
...
...
...

- ◆ Hose clamps up to 25 mm - 3094-

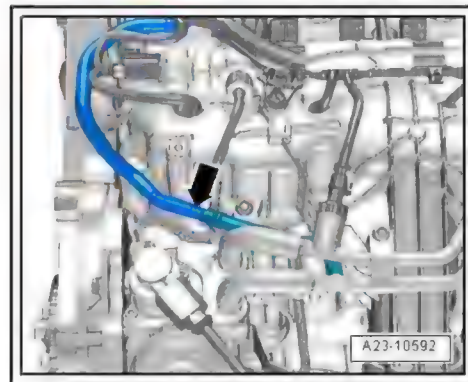


- ◆ Return flow meter - VAS 6684-



Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.
- Dry all components after cleaning.
- Clamp off fuel return hose -arrow- using a hose clamp -3094- .



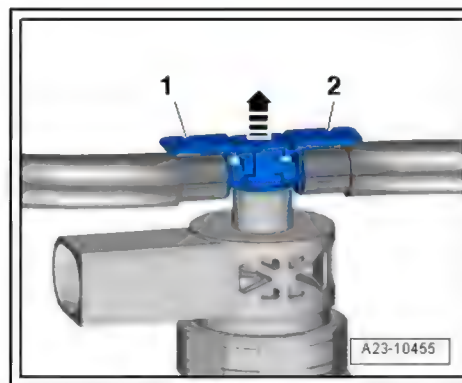
- Pull return line connections off injectors; to do so, press tabs -1- and -2- down and at the same time pull release pin upwards -arrow-.
- Connect hoses of return flow meter - VAS 6684- to return line connections of all three injectors.



Caution

Risk of damage to injectors when return lines are disconnected.

- ◆ **Do NOT press the accelerator during this test; the engine must only run at idling speed.**



- Start engine and let it idle for several minutes.
 - When the engine is warm and running at idling speed, the return flow rates at each of the 4 return lines must not differ by more than a small amount.
- 1 - Injectors OK. Return flow rate approx. identical on all injectors.
 - 2 - Injector for cylinder 3 not OK. Return flow rate greater than three times the volume of smallest measured return flow rate.



Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate.

- If one injector has a significantly higher return flow rate than the others it must be renewed ⇒ [page 246](#) .

Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

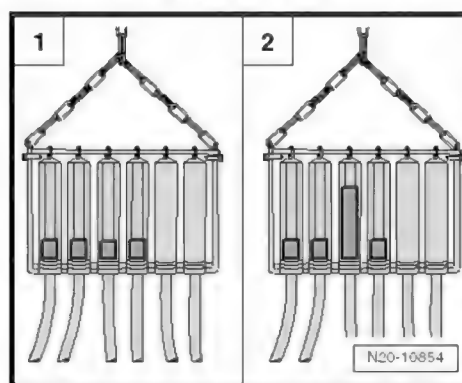
Lubricate all seals with engine oil or assembly oil before installing.

- Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Erase entry in event memory using ⇒ Vehicle diagnostic tester.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.





5.5 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

Special tools and workshop equipment required

- ◆ Return flow meter - VAS 6684-



Caution

- ◆ Observe ➔ *["3.1 Rules for cleanliness", page 5](#)*.
- ◆ Risk of malfunctions caused by dirt.

Procedure

Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

- Remove engine cover panel ➔ [page 41](#).
- Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.
- Dry all components after cleaning.



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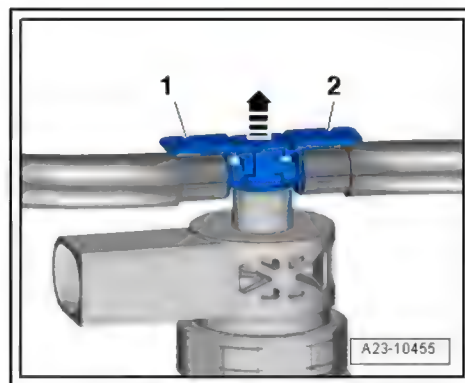


- Pull return line connections off injectors; to do so, press tabs -1- and -2- down and at the same time pull release pin upwards -arrow-.
- Connect hoses of return flow meter - VAS 6684- to return line connections of all four injectors.
- Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).
- Specification of return flow rate: 0 ml
- If fuel comes out of an injector, that injector must be renewed.

Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all seals with engine oil or assembly oil before installing.

- Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Erase entry in event memory using ➔ Vehicle diagnostic tester.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

5.6 Checking for injectors sticking open

If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

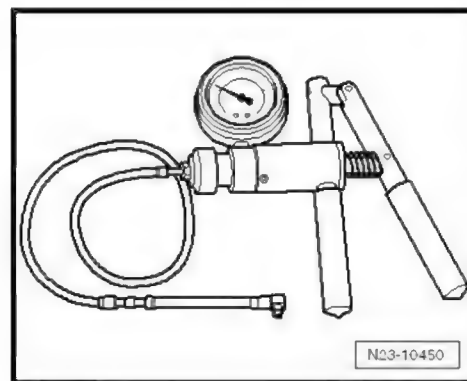
Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-





- ◆ Use a return line to make an -adapter-.



Caution

- ◆ **Observe** ⇒ **"3.1 Rules for cleanliness", page 5**.
- ◆ **Risk of malfunctions caused by dirt.**

- Erase entry in event memory using ⇒ Vehicle diagnostic tester.
- Remove engine cover panel ⇒ **page 41** .
- Clean all connections (with commercial cleaning solution or similar) before removing.



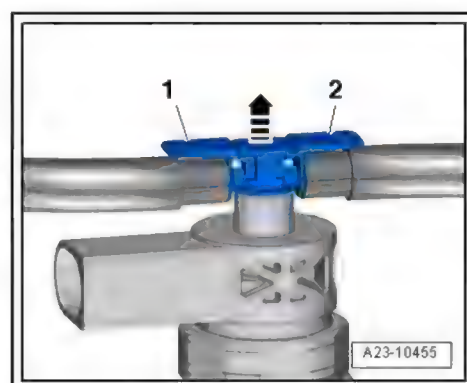
Note

- ◆ *Make sure all parts are clean; no dirt must be allowed to enter the fuel system.*
- ◆ *Check all cylinders in turn.*

- Dry all components after cleaning.

Start with cylinder No. 1.

- Pull return line connections off injectors; to do so, press tabs -1- and -2- down and at the same time pull release pin upwards -arrow-.
- Connect adapter to return line connection of injector to be tested after adapter has been cleaned and blown out.



- Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

If the vacuum reading remains the same for 30 seconds, the injector is OK.

If the injector is faulty, the vacuum reading will fall back to 0 bar within 2 to 3 seconds.

Repeat test if necessary; note drop in vacuum reading on hand vacuum pump - VAS 6213- .

- Renew faulty injectors ⇒ [page 246](#) .

Installing fuel return lines

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all seals with engine oil or assembly oil before installing.

- Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.



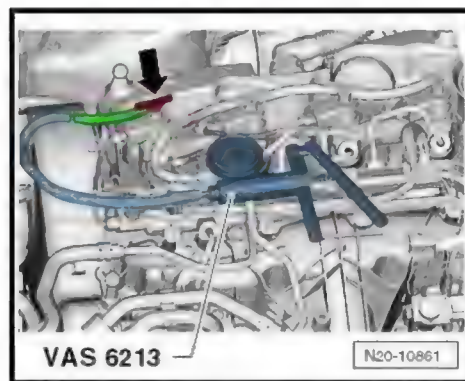
Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

5.7 Removing and installing injectors

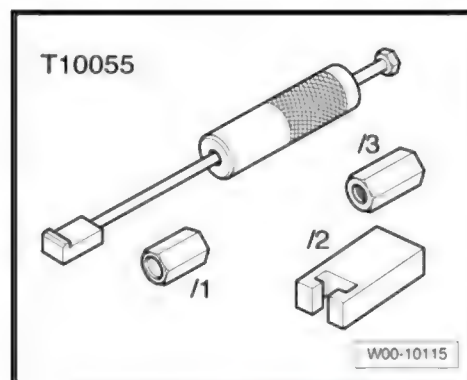
Special tools and workshop equipment required

- ◆ Cleaning kit - VAS 6811-





◆ Puller - T10055-



◆ Assembly sleeve - T10377-



◆ Puller - T10415-



Removing



Caution

- ◆ Observe ➔ ["3.1 Rules for cleanliness", page 5](#).
- ◆ Risk of malfunctions caused by dirt.

- Remove engine cover panel ➔ [page 41](#) .



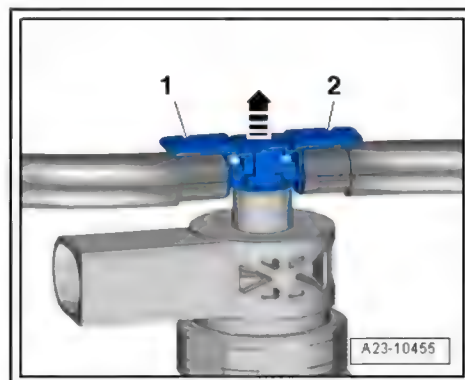
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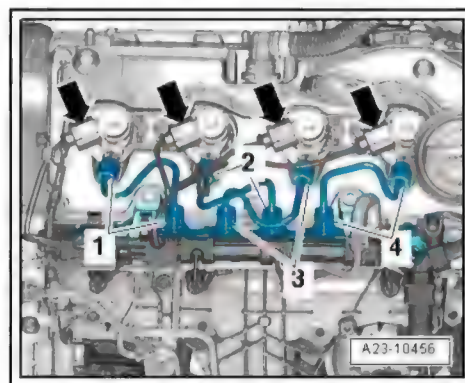
Caution

- ◆ *Mark cylinder numbers on injector units. They must always be re-installed on the same cylinders.*
- ◆ *Observe rules for cleanliness when working on the injection system.*
- ◆ *Plug open connections with suitable sealing caps immediately.*

- Pull return line connections off injectors; to do so, press tabs -1- and -2- down and at the same time pull release pin upwards -arrow-.



- Unplug electrical connectors -arrows- at injectors.
- Loosen union nuts of high-pressure pipes -1 to 4-.



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- Unscrew bolt -1- for clamping piece.



Note

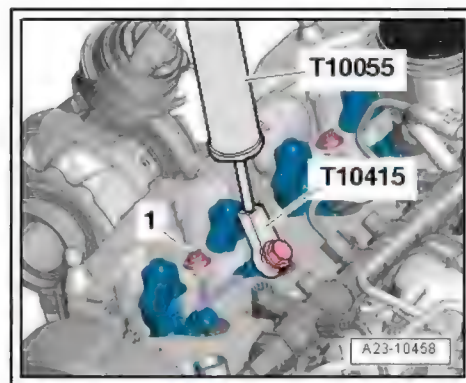
Leave clamping piece in position until adjacent injector is detached.



Caution

Risk of damage to injector if clamping piece is not kept straight.

- ◆ *First detach injectors for cylinders 2 and 4; then detach injectors for cylinders 1 and 3, and at the same time detach clamping piece.*



- Apply puller - T10055- with puller - T10415- as shown in illustration, and pull out injector upwards.



Note

To avoid damaging the sealing lip, rotate the injector while pulling it out.

- After removal, lay injectors on a clean cloth.

Important instructions for installing injectors:

When installing injectors, the following components must be renewed:

- ◆ Bolt for clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection



Note

- ◆ *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- ◆ *The high-pressure pipes can be re-used after performing the following checks:*
- ◆ *Check taper seats of high-pressure pipes for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*

If a used injector is being re-installed:

- Spray tip of injector nozzle with rust-releasing spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.
- To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
- Clean off deposits under the copper seal using a suitable scraper.



Caution

Risk of damage to injector sealing surface.

- ◆ *To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811-.*

- Renew O-ring for injector bore using assembly sleeve - T10377-.



Note

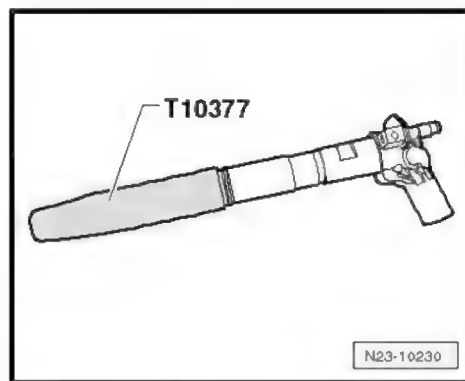
If injector seals in cylinder head cover are damaged, they must be renewed ⇒ [page 110](#).

- Install injectors.
- Slide clamping piece onto injectors; observe installation position.
- Always insert 2 injectors with clamping piece carefully into bores in cylinder head.
- Hand-tighten union nuts on high-pressure pipes. Make sure that connections are not under tension.
- Tighten clamping piece to specified torque.
- Press return line connections carefully over seals and onto injectors (check seal for damage before connecting return line). The catch should engage audibly. Then press release pin down carefully.

After renewing one or more injectors, the "injector delivery calibration values" and "injector voltage calibration values" for the new injectors must be written into the engine control unit.

Additionally, check that the "injector delivery calibration values" and "injector voltage calibration values" are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

After renewing one or more injectors, the learnt values for the fuel pressure regulating valve - N276- must be re-adapted; refer to "Guided Functions" on ⇒ Vehicle diagnostic tester.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

Tightening torques

- ◆ ⇒ ["5.1 Exploded view - injectors", page 236](#)

5.8 Removing and installing high-pressure pipes

Special tools and workshop equipment required

- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



Procedure

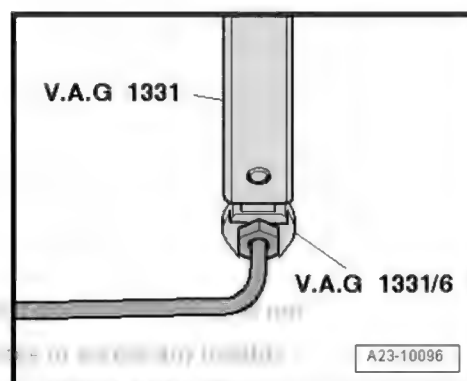


Note

- ◆ *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- ◆ *The high-pressure pipes can be re-used after performing the following checks:*
- ◆ *Check taper seats of high-pressure pipes for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*
- Use vacuum cleaner to remove dirt from taper seat at fuel rail.
- Clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.
- Lubricate threads of union nuts with fuel.
- Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).
- To tighten unions of high-pressure pipes to fuel rail and injectors, use torque wrench - V.A.G 1331- with open end spanner insert, AF 17 - V.A.G 1331/6- .
- Check fuel system for leaks ⇒ [page 223](#) .

Tightening torques

- ◆ ⇒ ["5.1 Exploded view - injectors", page 236](#)

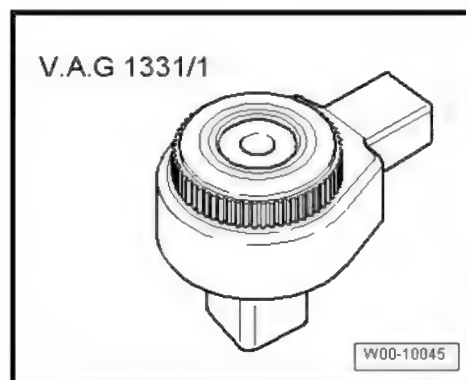


5.9 Removing and installing high-pressure reservoir (rail)

Special tools and workshop equipment required



◆ Ratchet - V.A.G 1331/1-



◆ Socket - T40055-



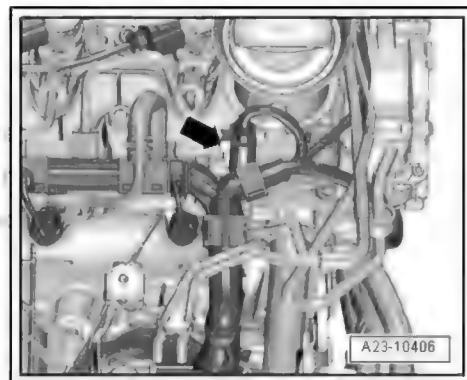
Removing



Caution

- ◆ Observe ⇒ "3.1 Rules for cleanliness", page 5.
- ◆ Risk of malfunctions caused by dirt.

- Remove engine cover panel ⇒ page 41.
- Unplug electrical connector -arrow- at fuel pressure regulating valve - N276-.

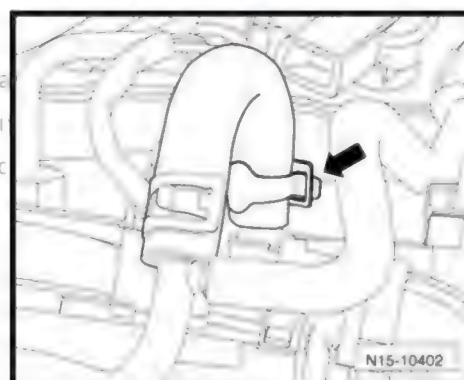
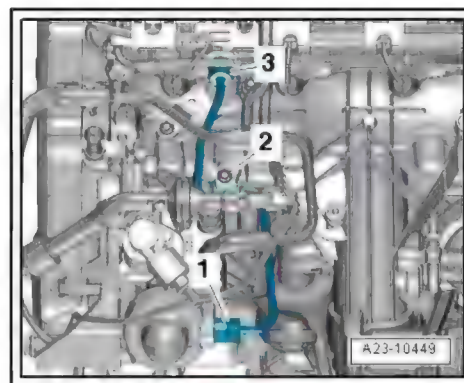


- Remove bolt -2- and union nuts -1 and 3- and detach high-pressure pipe.



- Release hose clip -arrow- and detach fuel return hose from fuel rail.
- Seal off open fuel return hose with a clean plug.

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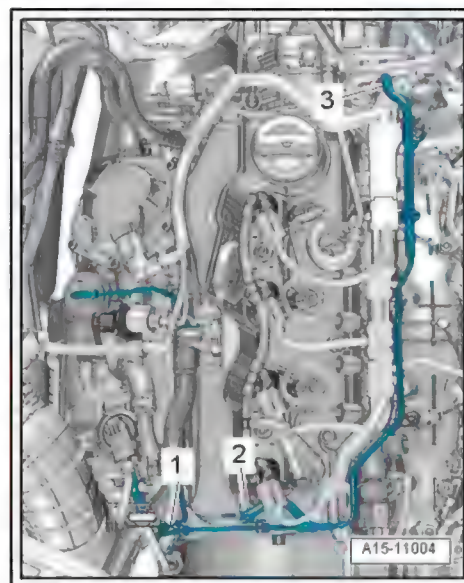
- Detach vacuum hose -3- and move clear.



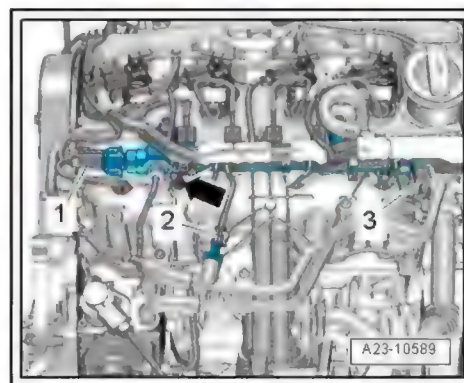
Note

Disregard items -1 and 2-.

- Unplug electrical connectors on glow plugs ➔ [page 305](#) .



- Unplug electrical connectors -1, 2, 3-.
- Remove bolt -arrow- and move wiring retainer with electrical wiring harness clear and press to one side.
- Loosen union nuts for high-pressure pipes using socket -T40055- .





- Remove union nuts -1- and bolts -arrows- and detach fuel rail.
- Set removed fuel rail (with high-pressure pipes attached) down on a clean cloth.
- Seal off openings in fuel rail with clean plugs.

Installing

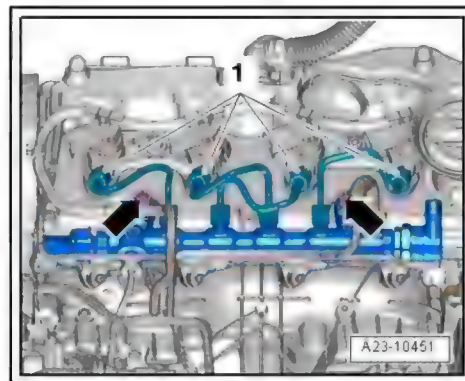
Installation is carried out in the reverse order; note the following:

- Install high-pressure pipes so they are free of stress.



Note

- ◆ *Note identification marks for cylinder allocation when re-installing high-pressure pipes.*
- ◆ *The high-pressure pipes can be re-used after performing the following checks:*
- ◆ *Check taper seats of high-pressure pipes for deformation and cracks.*
- ◆ *The bore of the pipe must not be distorted, restricted or otherwise damaged.*
- ◆ *Corroded pipes must not be used again.*



Tightening torques

- ◆ ⇒ ["5.1 Exploded view - injectors", page 236](#)



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The fuel pressure regulating valve - N276- -arrow- is located in the fuel rail. It maintains a constant pressure in the fuel rail and the injector pipes (high-pressure fuel circuit).

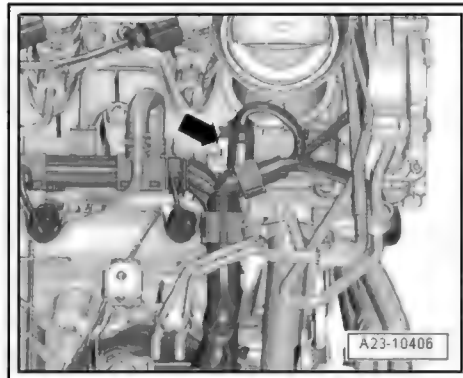
If the pressure in the high-pressure fuel circuit is too high, the regulating valve opens to allow some of the fuel to flow back from the fuel rail to the fuel tank via a return line.

If the pressure in the high-pressure fuel circuit is too low, the fuel pressure regulating valve - N276- closes and seals off the high-pressure section of the system from the low-pressure section.



Note

Fuel pressure regulating valve - N276- must always be renewed after it has been removed.



Removing



Caution

- ◆ Observe ⇒ *"3.1 Rules for cleanliness", page 5*.
- ◆ Risk of malfunctions caused by dirt.

- Remove fuel rail ⇒ [page 251](#).
- Before removal, clean area around thread for fuel pressure regulating valve - N276- using commercial cleaning solution or similar (no dirt must enter opening in fuel rail).



Note

Clean carefully; cleaning solution must not enter the electrical connector.

- Dry off fuel pressure regulating valve - N276-.
- Loosen union nut using open-end spanner insert, 30 mm - T10553- (at the same time, counterhold at hexagon flats on housing). Then unscrew and remove by hand.
- Extract dirt from opening in fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.
- Seal off opening in fuel rail with a clean plug.

Installing



Note

- ◆ The fuel pressure regulating valve - N276- has a deformable sealing lip and no separate seal; it can therefore be used only once.
- ◆ Check that sealing surfaces (deformable sealing lip) and threads on new fuel pressure regulating valve - N276- are not damaged.
- ◆ Check sealing surface at opening in fuel rail.
- ◆ The beginning of the thread, the deformable sealing lip and the O-ring of the fuel pressure regulating valve - N276- must be coated with diesel fuel.



- Screw on union nut by hand.
- Align new regulating valve so that connecting wire is free of tension after connector is attached.
- Hold regulating valve in this position by holding hexagon flats on housing of regulating valve with open-end spanner or pliers (water pump pliers or similar).
- Tighten union nut using open-end spanner insert, 30 mm - T10553- (at the same time, counterhold at hexagon flats on housing).

Tightening torques

◆ ⇒ ["5.1 Exploded view - injectors", page 236](#)

- Install fuel rail ⇒ [page 251](#) .
- After installation, run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Interrogate event memory.

After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Interrogate event memory again.

6.2 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

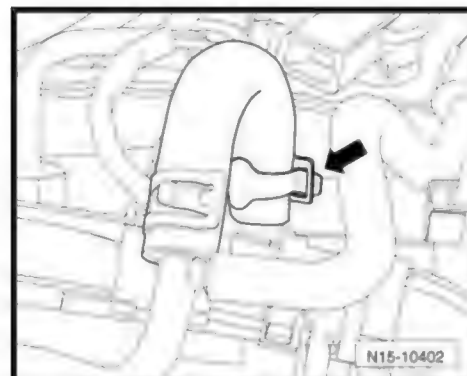
◆ Fuel-resistant measuring container



Caution

- ◆ Observe ⇒ ["3.1 Rules for cleanliness", page 5](#) .
- ◆ Risk of malfunctions caused by dirt.

- Remove engine cover panel ⇒ [page 41](#) .
- Release hose clip -arrow- and detach fuel return hose from fuel rail.
- Seal off open fuel return hose with a clean plug.





- Connect test hose -2- to return line connection of fuel rail -3-.
- Seal off open fuel return hose -1- with a clean plug.
- Hold end of test hose into measuring container -4- to measure return flow rate.

1) Checking while engine is running

- Start the engine and run at idling speed.
- Specification: more than 75 ml in 30 seconds

If specification is not obtained, fuel pressure regulating valve - N276- is defective.

2) Checking while engine is running

If condition for 1) is met, start engine and increase engine speed to ≥ 2000 rpm.

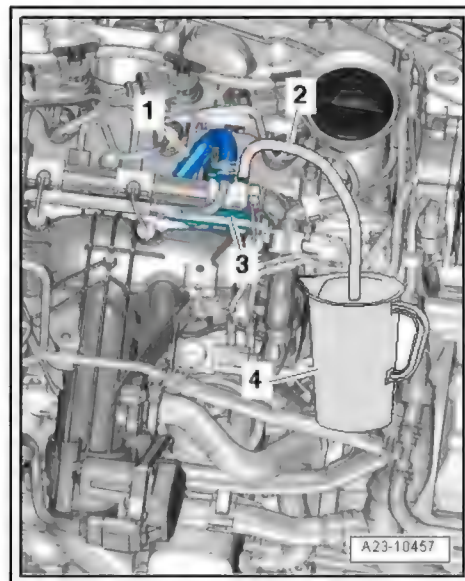
- Fuel is still discharged in the first few seconds after the engine is started
- Specification after a few seconds: return flow rate = 0 ml
- Drip leaks are permissible

If specification is not obtained, fuel pressure regulating valve - N276- is defective.

3) If engine can no longer be started

Perform check at cranking speed.

- Specification of return flow rate: 0 ml
- Drip leaks are permissible
- If specification is not obtained, fuel pressure regulating valve - N 276- is defective.



6.3 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

- ◆ Socket (27 mm) - T40218- or commercially available socket (27 mm)



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- ◆ Torque wrench





Note

- ◆ The fuel pressure sender - G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .
- ◆ Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.
- ◆ The fuel pressure sender - G247- has a deformable sealing lip.

Removing



Caution

- ◆ Observe ➔ "3.1 Rules for cleanliness", page 5 .
- ◆ Risk of malfunctions caused by dirt.

- Remove engine cover panel ➔ page 41 .
- Before removal, clean area around thread for fuel pressure sender - G247- using e.g. commercial cleaning solution.
- Make sure no dirt gets into opening in high-pressure reservoir.
- Clean carefully; cleaning solution must not enter the electrical connector.
- Dry off fuel pressure sender - G247- .



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- Unplug electrical connector -1- at fuel pressure sender - G247- .
- Unscrew fuel pressure sender - G247- using socket, 27 mm - T40218- .



Note

An open-end spanner must not be used for loosening or tightening.

- Extract dirt from opening in fuel rail (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.
- Seal off opening in high-pressure reservoir with a plug.

Installing



Note

- ◆ *Fuel pressure sender - G247- must always be renewed after it has been removed.*
- ◆ *Also check sealing surface at opening in high-pressure reservoir.*
- ◆ *Check that the deformable sealing lip and the thread on the new fuel pressure sender - G247- are not damaged.*
- ◆ *The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be coated with diesel fuel.*

- Screw in fuel pressure sender - G247- by hand.
- Then tighten fuel pressure sender - G247- to specified torque.

Tightening torques

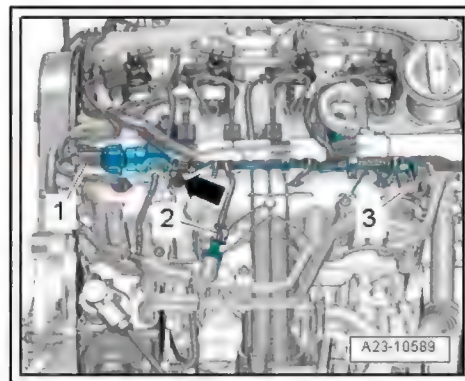
- ◆ ⇒ [“5.1 Exploded view - injectors”, page 236](#)
- After installing fuel pressure sender - G247- , leave engine running at moderate speed for a few minutes when bleeding fuel system and then switch off again.



Note

The fuel system is “self-bleeding”; do NOT open the high-pressure connections.

- Switch off ignition.
- Carefully check the entire fuel system for leaks.
- Renew affected component if leakage still occurs after tightening to correct torque.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.





i Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- After road test, interrogate event memory again.

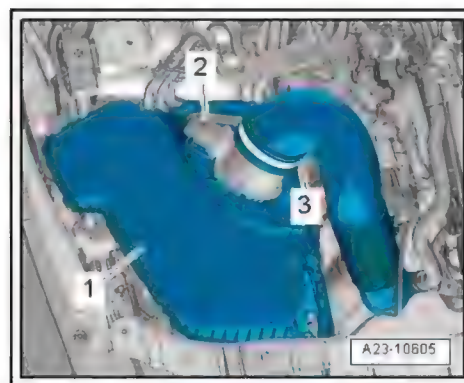
6.4 Removing and installing air mass meter - G70-

Removing

- Unplug electrical connector -2- at air mass meter - G70- .
- Open hose clip -3- on air hose and disconnect hose at air mass meter - G70- .
- Unscrew both bolts from air mass meter - G70- .
- Then carefully pull air mass meter - G70- out of guide on air cleaner housing.

Installing

To ensure that the air mass meter -G70- functions correctly, it is important to observe the following notes and procedures.



i Note

- ◆ *If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter and falsify the detected air mass values. This will cause a loss of power as the calculated injection quantities will be too low.*

- ◆ *Use a lubricant (silicone-free) when installing air hoses.*

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

- Check air mass meter and air hose (engine intake side) for salt residue, dirt and leaves.

- Check intake duct as far as air filter element for dirt. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required. Removing and installing air cleaner ⇒ [page 227](#) .

The remaining installation steps are carried out in the reverse sequence.

7 High-pressure pump

⇒ "7.1 Exploded view - high-pressure pump", page 262

⇒ "7.2 Removing and installing high-pressure pump", page 263

7.1 Exploded view - high-pressure pump

1 - Bracket for ancillaries

- ❑ Removing and installing
⇒ [page 48](#)

2 - Bolt

- ❑ 2x
- ❑ Renew
- ❑ 20 Nm + 180°

3 - Hub

- ❑ Use counterhold tool - T10051- when loosening and tightening
- ❑ To remove, use puller - T40064-

4 - High-pressure pump sprocket

5 - Bolt

- ❑ 20 Nm

6 - Nut

- ❑ 95 Nm

7 - Bolt

- ❑ Renew
- ❑ 20 Nm +45°

8 - High-pressure pump

- ❑ With fuel metering valve - N290- (do not open)
- ❑ After renewing, first fuel filling operation **MUST** be performed (it is important not to allow pump to run while it is still empty) ⇒ [page 222](#)

- ❑ After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester
- ❑ Removing and installing ⇒ [page 263](#)

9 - Fuel supply hose

10 - Fuel return hose

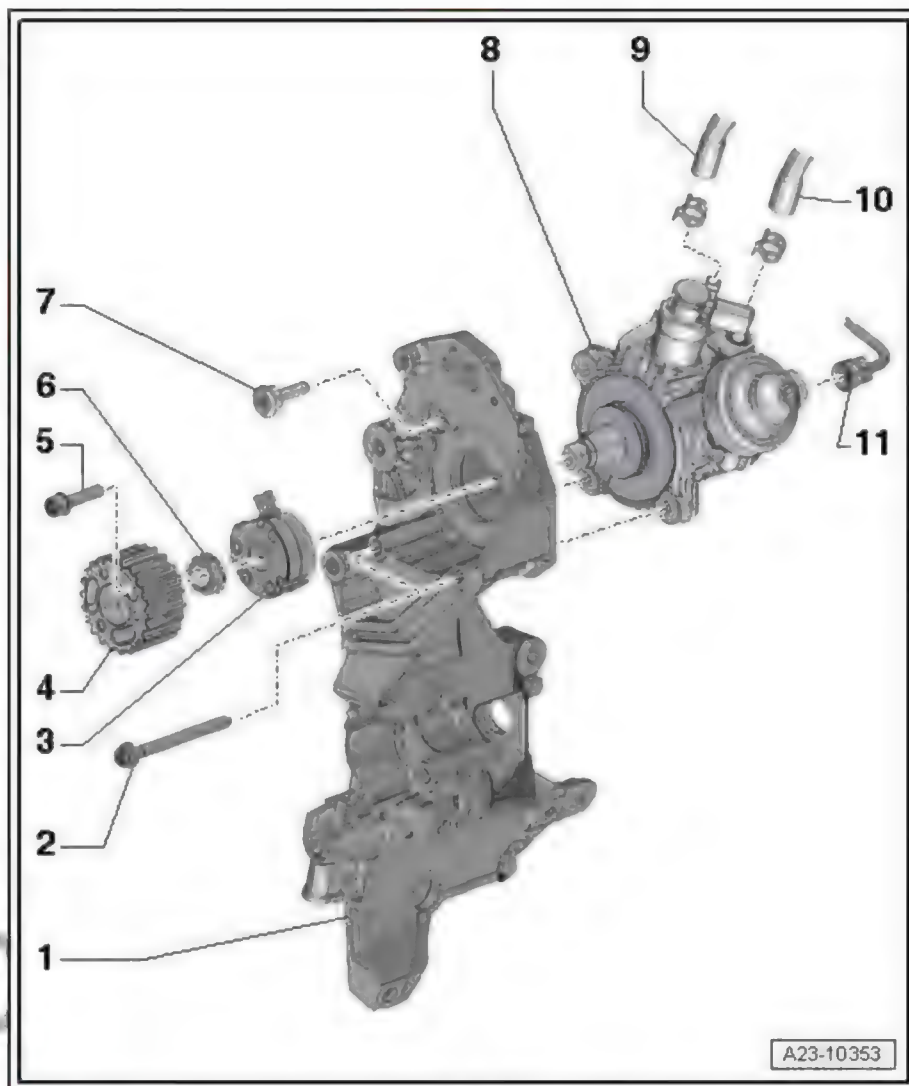
11 - High-pressure pipe

- ❑ Between high-pressure pump and fuel rail



Note

- ◆ The high-pressure pipes can be re-used after performing the following checks:





- ◆ Check taper seat for deformation and cracks.
- ◆ The bore of the pipe must not be distorted, restricted or otherwise damaged.
- ◆ Corroded pipes must not be used again.

- ☐ Install free of stress
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

7.2 Removing and installing high-pressure pump



Caution

Risk of malfunctions caused by dirt.

- ◆ Observe ➔ **"3.1 Rules for cleanliness", page 5.**

Running when dry causes irreparable damage to high-pressure pump.

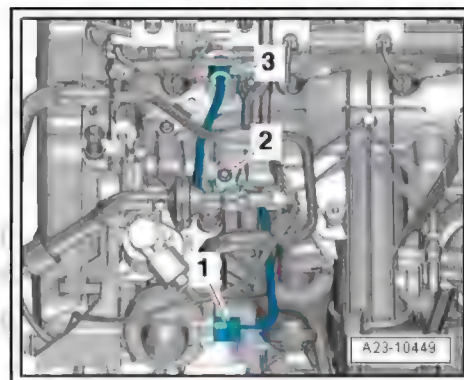
- ◆ If the high-pressure pump has been removed or renewed, it is important to fill and bleed the fuel system before the engine is started for the first time
➔ **"1.3 Filling and bleeding fuel system", page 222.**

Removing

- Remove toothed belt from camshaft and high-pressure pump
➔ **page 83.**
- Remove bolt -2- and union nuts -1 and 3- and detach high-pressure pipe.



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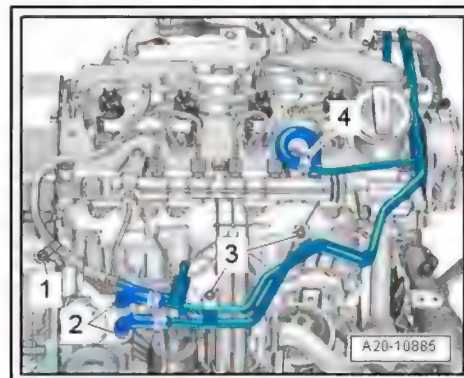


- Remove bolts -1 and 3-.
- Release hose clips -2- and detach fuel hoses.
- Pull fuel lines upwards off cylinder head cover and press clear to one side.



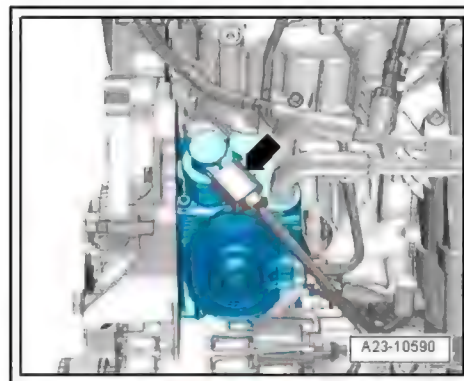
Note

Disregard -item 4-.

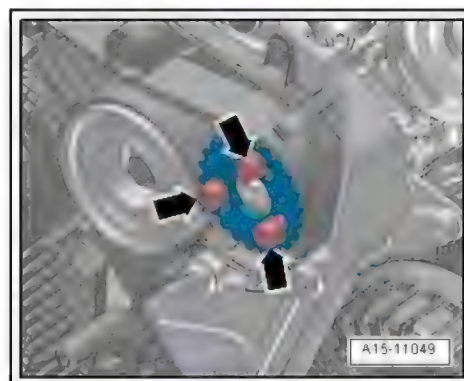




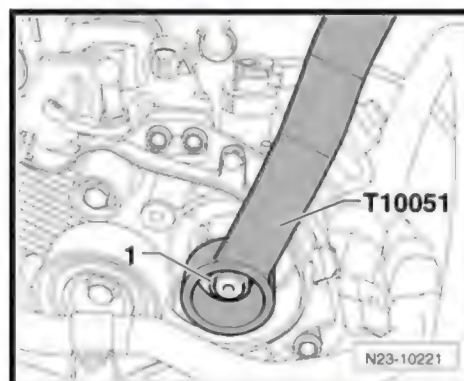
- Unplug electrical connector -arrow- at fuel metering valve - N290- .



- Using an M10 bit, remove bolts -arrows- for toothed belt sprocket on high-pressure pump.



- Counterhold using counterhold tool - T10051- and remove nut -1- at hub of high-pressure pump.



- Apply puller - T40064- with thrust piece - T40064/1- and pin - T40064/2- as shown in illustration and pull hub off high-pressure pump. If necessary, counterhold using an open-end private or

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- Unscrew securing bolts -arrows- for high-pressure pump.
- Carefully take out high-pressure pump.

Installing

Installation is carried out in reverse order; note the following:

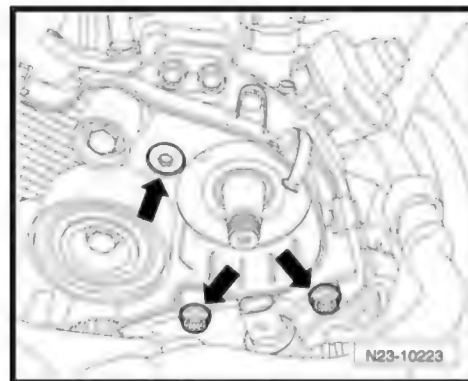
- Install toothed belt for high-pressure pump ⇒ [page 83](#) .
- Install high-pressure pipe ⇒ [page 250](#) .



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ *If the high-pressure pump has been removed or renewed, it is important to fill and bleed the fuel system before the engine is started for the first time
⇒ "1.3 Filling and bleeding fuel system", page 222 .*



- Reset learnt values after renewing high-pressure pump ⇒ Vehicle diagnostic tester, Guided Functions, 01 - Reset learnt values.

Tightening torques

- ◆ ⇒ ["7.1 Exploded view - high-pressure pump", page 262](#)



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8 Lambda probe

⇒ "8.1 Exploded view - Lambda probe", page 266

⇒ "8.2 Removing and installing Lambda probe", page 266

8.1 Exploded view - Lambda probe

1 - Turbocharger

- ☐ With position sender for charge pressure positioner - G581-

2 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing ⇒ [page 266](#)
- ☐ New Lambda probes are coated with an assembly paste
- ☐ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- ☐ The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- ☐ 55 Nm

3 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing ⇒ [page 286](#)

4 - Pressure differential sender - G505-

- ☐ Removing and installing ⇒ [page 282](#)
- ☐ Pressure pipes to particulate filter: 45 Nm
- ☐ Tighten bolt to 4.5 Nm

5 - Exhaust gas temperature sender 4 - G648-

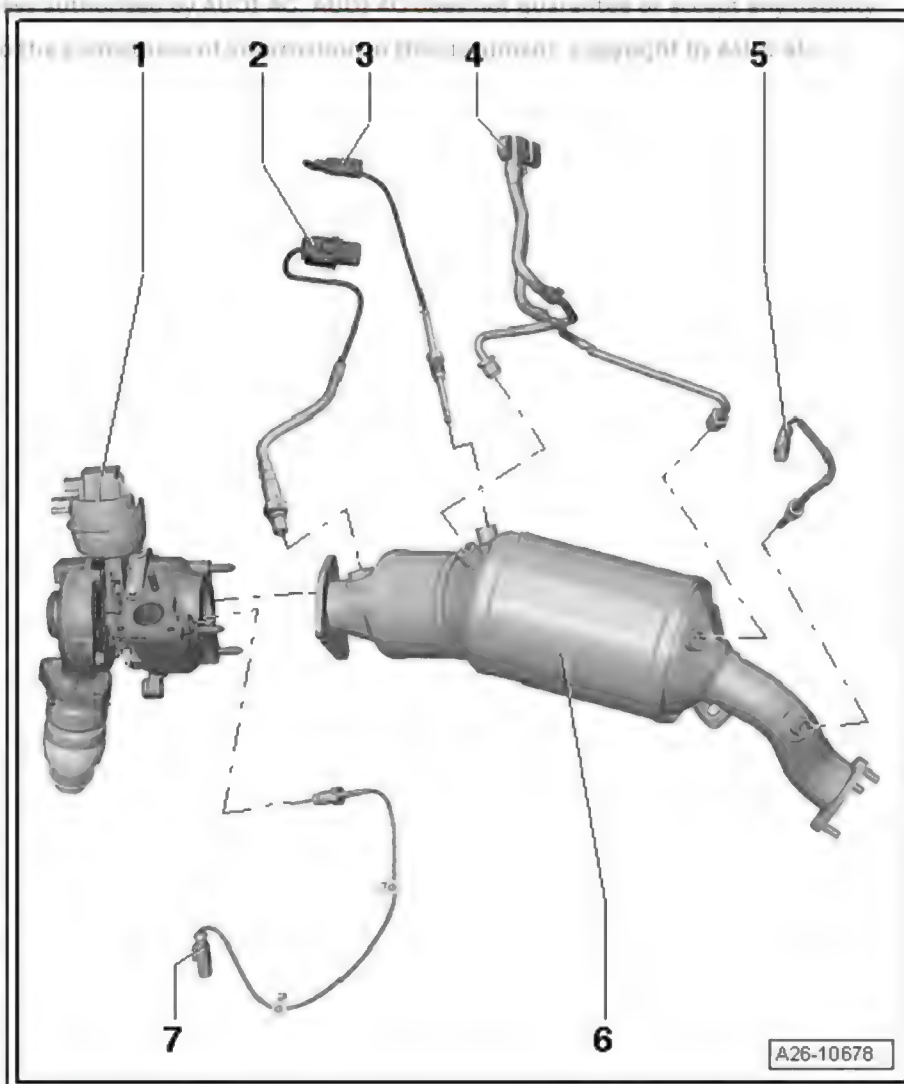
- ☐ Removing and installing ⇒ [page 288](#)

6 - Particulate filter

- ☐ Adaption must be performed after renewing particulate filter. Use ⇒ Vehicle diagnostic tester

7 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing ⇒ [page 285](#)



8.2 Removing and installing Lambda probe

Special tools and workshop equipment required

◆ Lambda probe open ring spanner set - 3337-



Removing



WARNING

When working on all parts of the exhaust system:

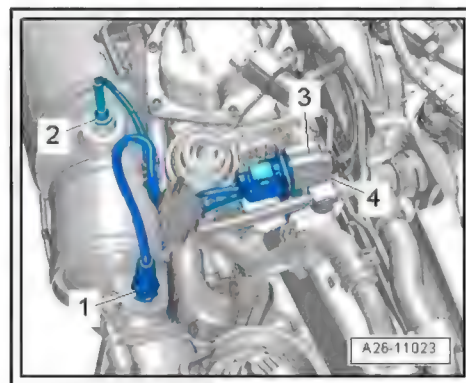
- ◆ *Observe safety precautions when working on the exhaust system*
⇒ *"2.6 Safety precautions when working on the exhaust system", page 4*.

- Remove engine cover panel ⇒ [page 41](#).
- Unplug electrical connector -3- for Lambda probe - G39- and move electrical wiring clear.
- Unscrew Lambda probe - G39- -item 1- using a tool from Lambda probe open ring spanner set - 3337-.



Note

Disregard items -2 and 4-.



Installing

Installation is carried out in reverse order; note the following:



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ⇒ *Electronic parts catalogue**
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*

Tightening torques

- ◆ ⇒ ["8.1 Exploded view - Lambda probe", page 266](#)



9 Engine control unit

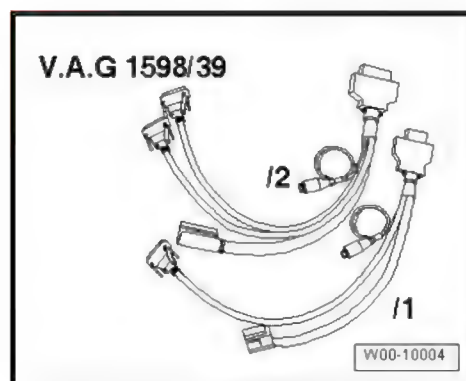
⇒ "9.1 Wiring and component check", page 268

⇒ "9.2 Removing and installing engine/motor control unit J623 ",
page 269

9.1 Wiring and component check

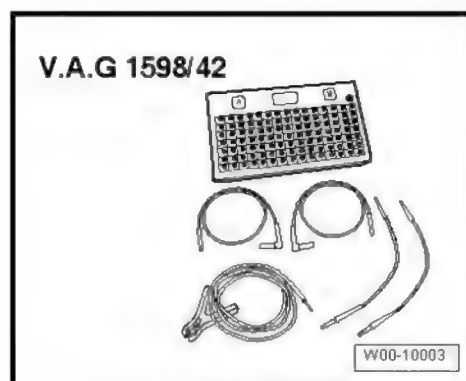
Special tools and workshop equipment required

◆ Adapter cable - V.A.G 1598/39-1-



◆ Adapter cable - V.A.G 1598/39-2-

◆ Test box - V.A.G 1598/42-



◆ Vehicle diagnostic tester

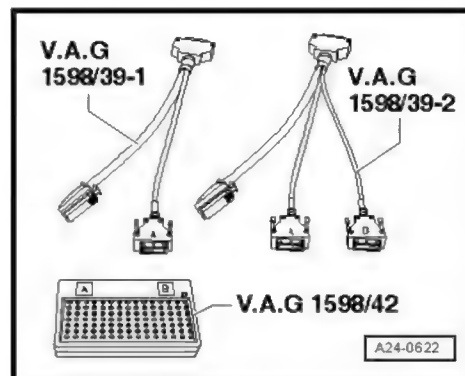


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Note

- ◆ The test box has 105 sockets. The connecting cable can be disconnected from the test box. This means that only the cable (and not the test box) has to be purchased for future engine control units with different types of connectors.
- ◆ The smaller of the two connectors on the engine control unit has the contacts 1 to 60. The larger of the two connectors has the contacts 1 to 94.
- ◆ To carry out tests on the 60-pin wiring harness connector, the adapter cable - V.A.G 1598/39-1- is connected to connector "A" on the test box. For components connected to 60-pin wiring harness connector ➔ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ To carry out tests on the 94-pin wiring harness connector, the adapter cable - V.A.G 1598/39-2- must be connected to connectors -A- and -B- on the test box. For components connected to 94-pin wiring harness connector ➔ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The test box - V.A.G 1598/42- is designed so it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.
- ◆ The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).
- ◆ The relevant test procedure will state whether it is necessary to also connect the engine control unit to the test box.



WARNING

To prevent irreparable damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

Remove engine control unit ➔ [page 269](#) :

- Connect the test box - V.A.G 1598/42- to wiring harness with adapter cable - V.A.G 1598/39-1- or adapter cable - V.A.G 1598/39-2- . Connect earth clip of test box to negative terminal of battery. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in appropriate repair procedures.

Perform the following after reconnecting engine control unit:

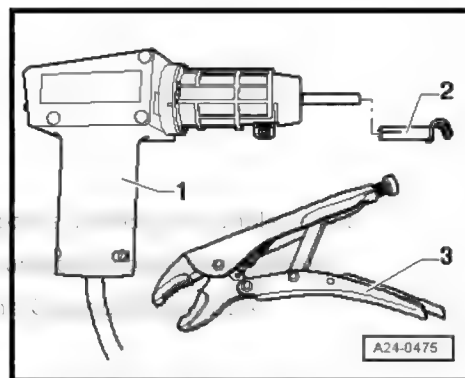
- Interrogate event memory and erase if necessary.

9.2 Removing and installing engine/motor control unit - J623-

Special tools and workshop equipment required



- ◆ Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-

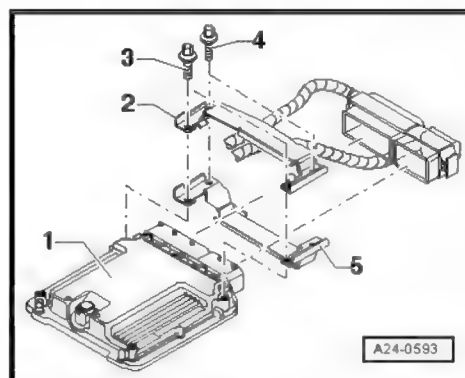


- ◆ Small, commercially available mole grips -3-



Note

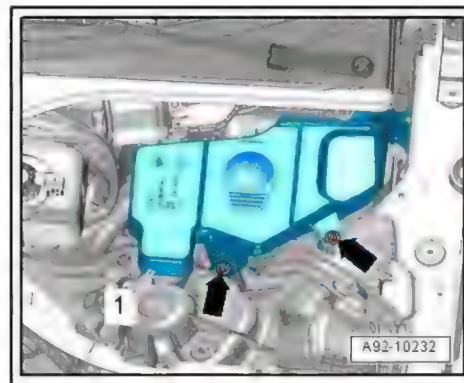
- ◆ *Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/gearbox combination.*
- ◆ *The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.*
- ◆ *The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).*



Removing

- If the engine control unit - J623- is renewed, the adaption values must be read out and stored before the engine control unit - J623- is removed.
- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Drive train**
 - ◆ **Select engine code and engine**
 - ◆ **01 - Self-diagnosis compatible systems**
 - ◆ **01 - Engine electronics**
 - ◆ **01 - Engine electronics, functions**
 - ◆ **01 - Replace control unit**
- Switch off ignition and remove ignition key after storing electronic file containing adaption values.
- If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, the adaption values must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.
- Switch off ignition and remove ignition key.
- Remove plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber cover .

- Unscrew bolts -arrows- and pull filler neck out of washer fluid reservoir and through opening in body to right side.



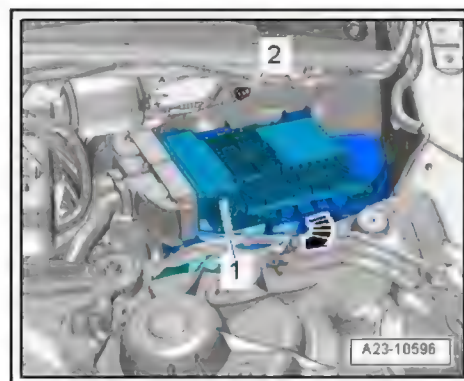
- Release catch -arrow- and detach engine control unit - J623-
-item 1-.



Note

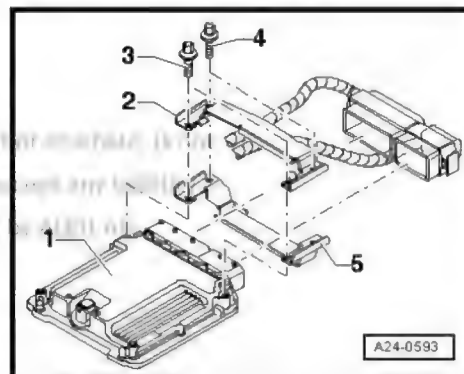
Disregard -item 2-.

Perform the following work steps if a protective housing is fitted:



The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.

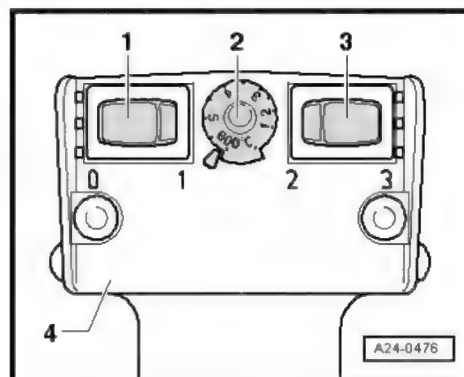


- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



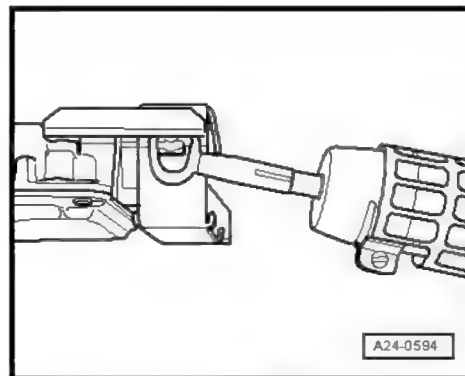
WARNING

Heating the thread of the locking plate also heats up the shear bolts and parts of the metal housing. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

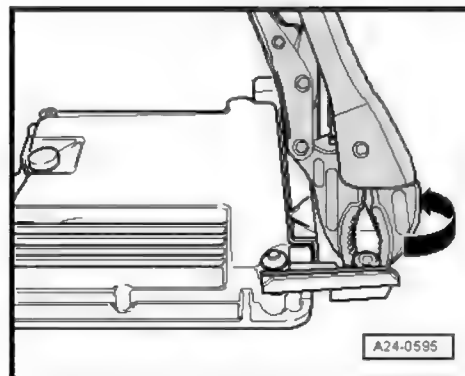




- Apply heat to the threads of the shear bolts on the connector side for approx. 25 to 30 seconds.



- Unscrew shear bolts using suitable vice-grip pliers (see arrow in illustration).
- The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
- Detach protective housing from control unit connectors.
- Release connectors on engine control unit and unplug connectors.
- Take out old engine control unit - J623- and install new engine control unit - J623- .



Installing

Installation is performed in the reverse sequence.

- It is important that the protective housing is re-fitted on the engine/motor control unit - J623- (if fitted previously).
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- After the engine control unit - J623- has been renewed, the "Injector delivery calibration" and the "Injector voltage calibration" must also be re-adapted in the engine control unit (these functions influence engine power and exhaust emissions).
- On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit - J623- via an adaption procedure.

After installing a new engine control unit, the following operation must be performed:

- Activate engine control unit using ⇒ Vehicle diagnostic tester in Guided Functions mode, function 01 - Replace control unit.





26 – Exhaust system

1 Exhaust pipes/silencers

⇒ "1.1 Exploded view - silencers", page 273

⇒ "1.2 Removing and installing front exhaust pipe", page 275

⇒ "1.3 Separating exhaust pipes/silencers", page 276

⇒ "1.4 Renewing tailpipes", page 278

⇒ "1.5 Stress-free alignment of exhaust system", page 279

⇒ "1.6 Checking exhaust system for leaks", page 280

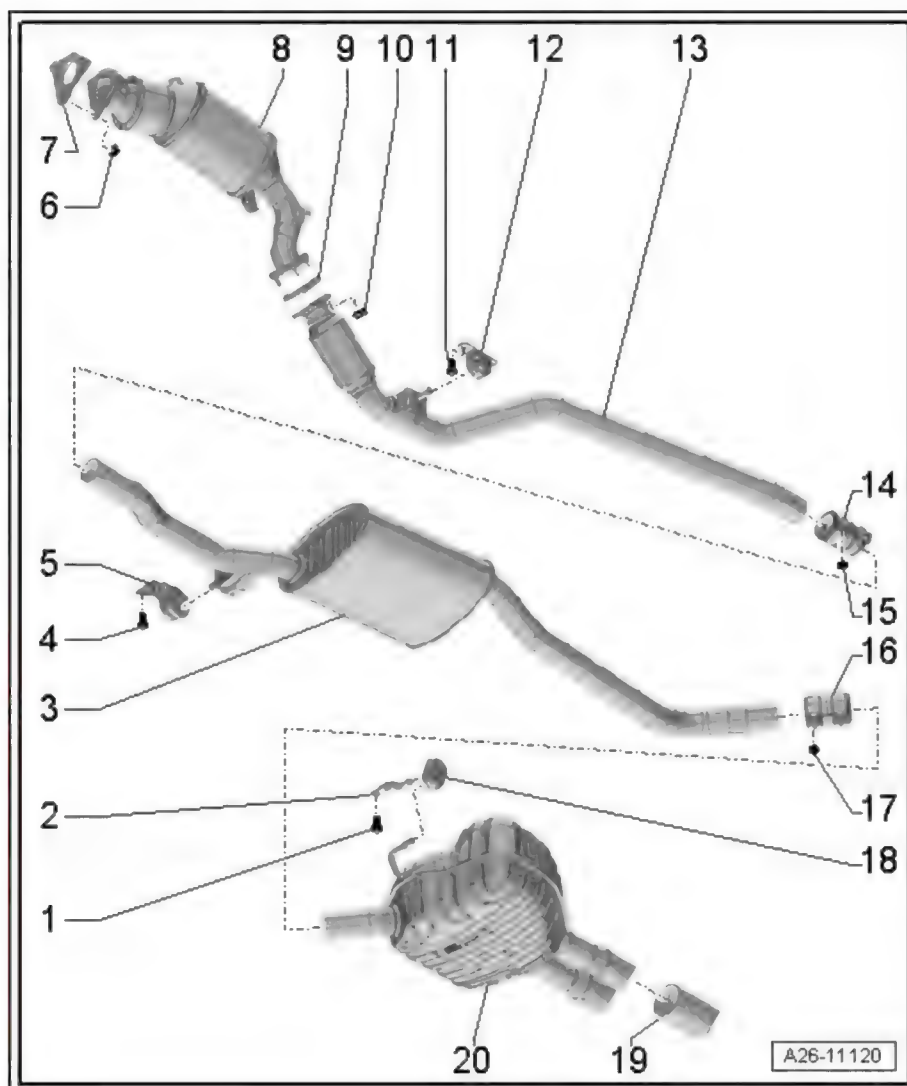
1.1 Exploded view - silencers



Note

After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamp and align silencers and exhaust pipe so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.

- 1 - Bolt
 - ☐ 23 Nm
- 2 - Bracket
- 3 - Centre silencer
 - ☐ Combined in one unit with rear silencers as original equipment. Can be renewed separately for repair purposes
 - ☐ Cutting point between centre silencer and rear silencer ⇒ [page 276](#)
 - ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)
- 4 - Bolt
 - ☐ 23 Nm
- 5 - Mounting
 - ☐ Renew if damaged
 - ☐ Check preload ⇒ "1.5 Stress-free alignment of exhaust system", page 279
- 6 - Nut
 - ☐ Renew
 - ☐ 23 Nm
- 7 - Gasket
 - ☐ Renew
- 8 - Particulate filter
 - ☐ With catalytic converter
 - ☐ With pressure line for





pressure differential
sender - G505-

- ☐ Removing and installing ⇒ [page 281](#)
- ☐ Mounting components ⇒ [page 275](#)
- ☐ After renewing, perform **Adaption** in **Guided Functions** ⇒ Vehicle diagnostic tester

9 - Gasket

- ☐ Renew

10 - Nut

- ☐ Renew
- ☐ 23 Nm

11 - Bolt

- ☐ 23 Nm

12 - Mounting

- ☐ Renew if damaged
- ☐ Check preload ⇒ ["1.5 Stress-free alignment of exhaust system", page 279](#)

13 - Front exhaust pipe

- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Protect against knocks and impact
- ☐ Removing and installing ⇒ [page 275](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)

14 - Clamp (front)

- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 279](#)
- ☐ Installation position ⇒ [page 275](#)
- ☐ Tighten bolted connections evenly

15 - Nut

- ☐ 23 Nm

16 - Clamp (rear)

- ☐ For separate replacement of centre and rear silencers
- ☐ Before tightening, align exhaust system so it is free of stress ⇒ [page 279](#)
- ☐ Installation position ⇒ [page 275](#)
- ☐ Tighten bolted connections evenly

17 - Nut

- ☐ 23 Nm

18 - Rubber mounting

- ☐ Renew if damaged

19 - Tailpipe

- ☐ Can be renewed separately for repair purposes ⇒ [page 278](#)

20 - Rear silencer

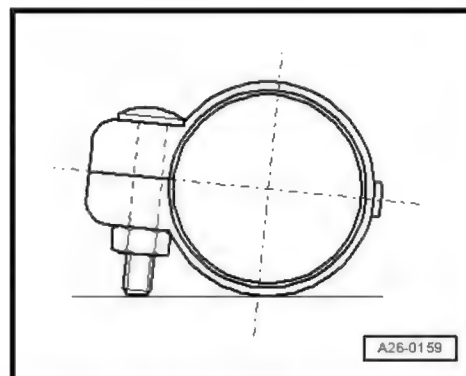
- ☐ Combined as one unit with centre silencer and tailpipes as original equipment Can be renewed separately for repair purposes
- ☐ Cutting point between centre silencer and rear silencer ⇒ [page 276](#)
- ☐ Renewing tailpipes ⇒ [page 278](#)
- ☐ Align exhaust system so it is free of stress ⇒ [page 279](#)



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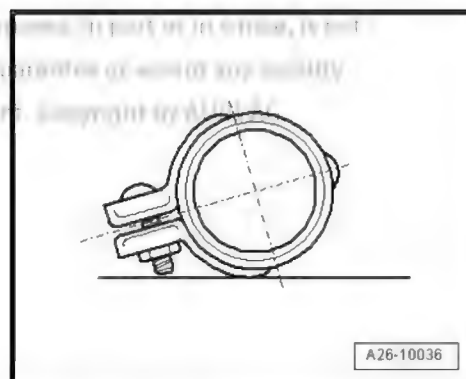
Installation position of front clamp

- Install clamp so that ends of bolts do not protrude beyond bottom of clamp.
- Bolted connection faces to left.



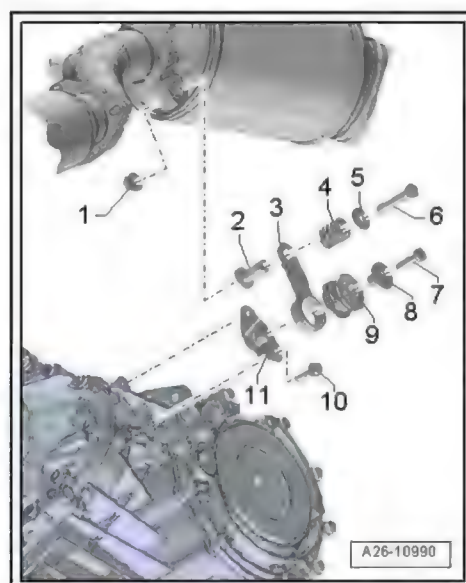
Installation position of rear clamps

- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.
- Bolted connection faces to left.



Components of mountings for particulate filter

- 1 - Nut
- 2 - Spacer sleeve
- 3 - Bracket
- 4 - Compression spring
- 5 - Washer
- 6 - Bolt, 23 Nm
- 7 - Bolt, 23 Nm
- 8 - Spacer sleeve
- 9 - Buffer
- 10 - Bolt, 23 Nm
- 11 - Bracket



1.2 Removing and installing front exhaust pipe

Removing

- Remove noise insulation (rear) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

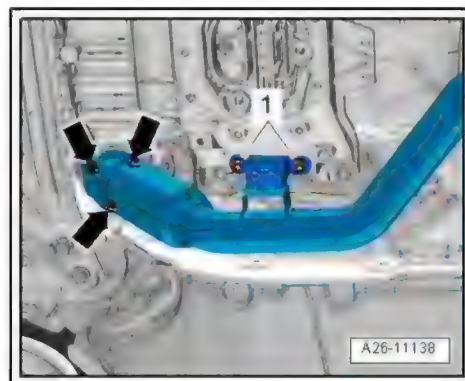


WARNING

When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*
⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

- Remove bolts -1- and nuts -arrows-.



Caution

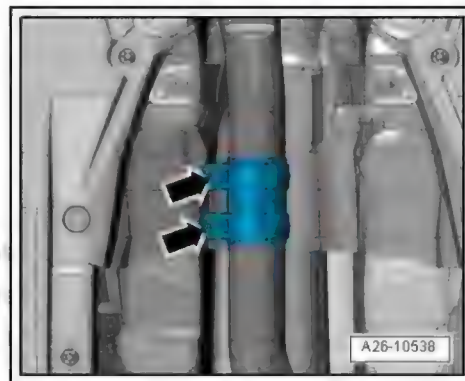
Risk of damage to flexible joints in front exhaust pipe

- ◆ *Do not bend flexible joints in front exhaust pipe more than 10°.*

- Loosen bolts -arrows-, push back clamp and detach front exhaust pipe.

Installing

Installation is carried out in reverse order; note the following:



Note

Renew gasket and nuts.

- Align the exhaust system so it is free of stress ⇒ [page 279](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencers", page 273](#)
- ◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

1.3 Separating exhaust pipes/silencers

- ◆ The connecting pipe can be cut through at the cutting location in order to renew the centre and rear silencers separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

Special tools and workshop equipment required

- ◆ Chain pipe cutter - VAS 6254-



Procedure

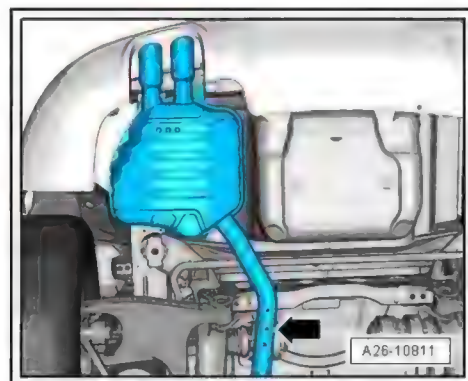


WARNING

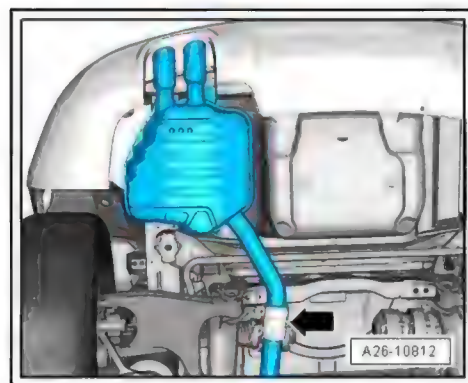
When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*
⇒ *"2.6 Safety precautions when working on the exhaust system", page 4* .

- Cut through exhaust pipe at right angles at the position marked -arrow- using chain pipe cutter - VAS 6254- .

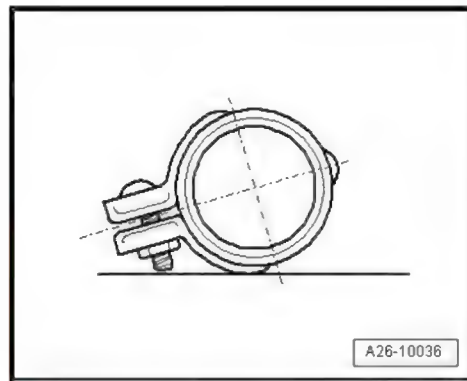


- Position centre of clamps -arrow- over cutting location.



- ### Tightening torques

- ◆ ⇒ “1.1 Exploded view - silencers”, page 273



1.4 Renewing tailpipes

- ◆ The tailpipes can be cut through at the point marked so that the tailpipes can be renewed separately.
- ◆ The cutting point is marked by an indentation on the circumference of the tailpipe.

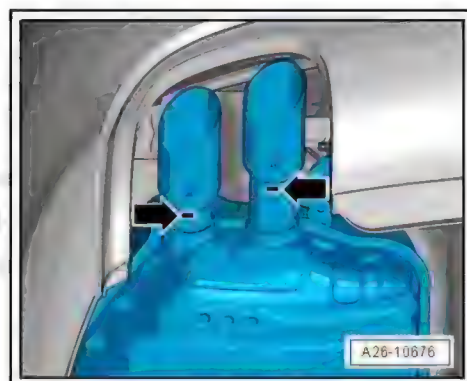
Special tools and workshop equipment required

- ◆ Chain pipe cutter - VAS 6254-



Procedure

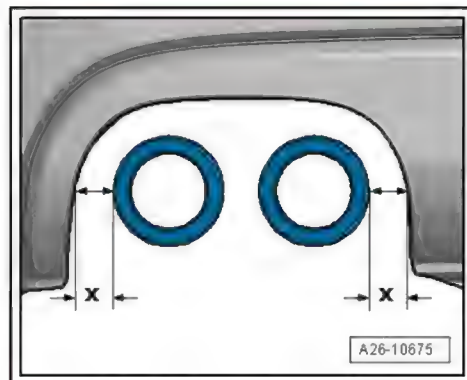
- Cut through tailpipe at right angle at the position marked by -arrows- using chain pipe cutter - VAS 6254-.
- Fit tailpipes.



- Check clearance between tailpipes and bumper:
 - Dimension -x- (left-side) = dimension -x- (right-side)
- Tighten bolt connections on clamps.

Tightening torques

- ◆ ⇒ "1.1 Exploded view - silencers", page 273



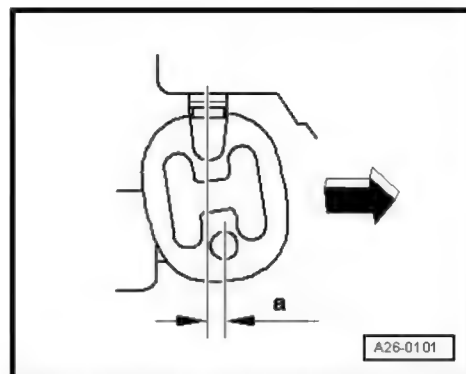
1.5 Stress-free alignment of exhaust system

Procedure

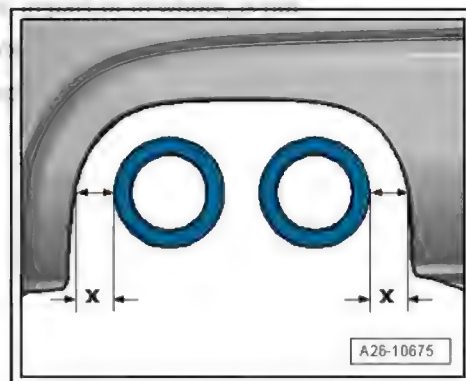
- The exhaust system must be aligned when it is cool.

Vehicles without clamps between centre silencer and rear silencer

- Loosen bolted connections on front clamp.
- Push exhaust system towards front of vehicle -arrow- so that rear mountings for rear silencer are preloaded by -a- = 11 ... 15 mm.
- Align rear silencer so it is horizontal.

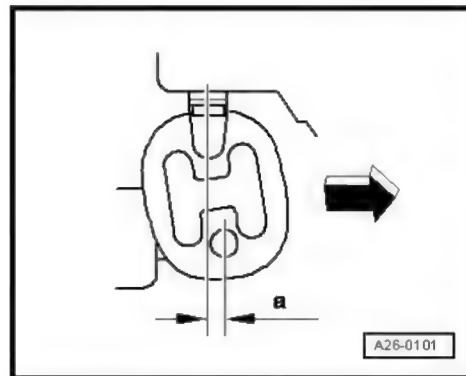


- Check clearance between tailpipes and bumper:
- Dimension -x- (left-side) = dimension -x- (right-side)
- Tighten bolt connections on clamp evenly.

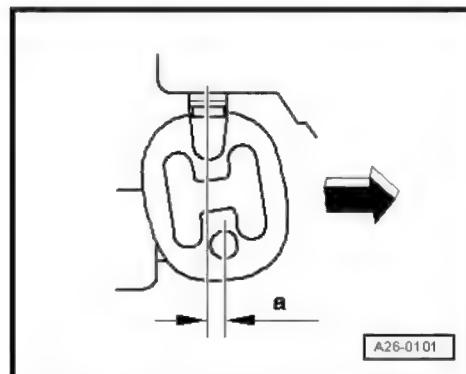


Vehicles with clamps between centre silencer and rear silencer

- Loosen bolted connections on front and rear clamps.
- Push centre silencer towards front of vehicle -arrow- until mounting for centre silencer is preloaded by -a- = 6 ... 10 mm.
- Tighten bolt connections on front clamp evenly.



- Push rear silencer towards front of vehicle -arrow- so that rear mounting for rear silencer is preloaded by -a- = 11 ... 15 mm.
- Align rear silencer so it is horizontal.

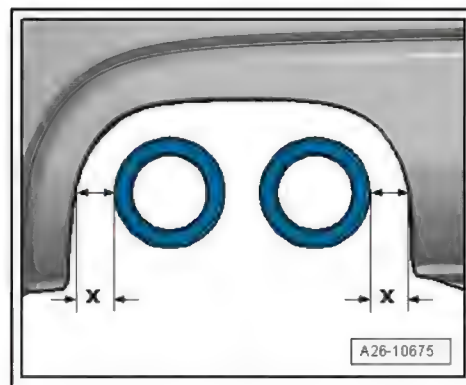




- Check clearance between tailpipes and bumper:
- Dimension -x- (left-side) = dimension -x- (right-side)
- Tighten bolted connections on rear clamps evenly.

Tightening torques

- ♦ ⇒ ["1.1 Exploded view - silencers", page 273](#)



1.6 Checking exhaust system for leaks

- Start the engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plug).
- Listen for noise at connection points of cylinder head/exhaust manifold, turbocharger/exhaust manifold, turbocharger/particulate filter etc. to locate any leaks.
- Rectify any leaks that are found.



2 Emission control system

⇒ ["2.1 Removing and installing particulate filter", page 281](#)

⇒ ["2.2 Removing and installing pressure differential sender G505", page 282](#)

2.1 Removing and installing particulate filter

Special tools and workshop equipment required

◆ Tool set - T10395 A-



Removing



WARNING

When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*
⇒ ["2.6 Safety precautions when working on the exhaust system", page 4](#).

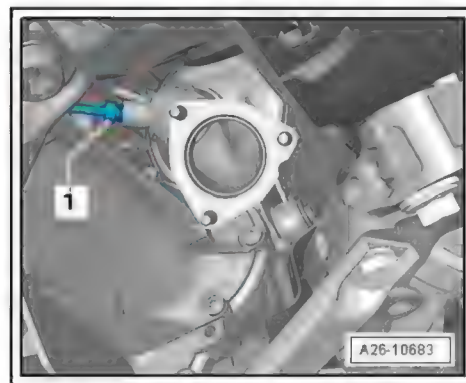
- Remove front exhaust pipe ⇒ [page 275](#).
- Unscrew exhaust gas temperature sender 4 - G648- -item 1- using a tool from tool set - T10395 A-.



Note

Fit all cable ties in the original positions when installing.

- Remove coolant pipe (rear right) ⇒ [page 183](#).
- Remove exhaust gas recirculation cooler ⇒ [page 291](#).
- Remove turbocharger ⇒ [page 203](#).
- Remove oil pressure switch - F1- ⇒ [page 146](#).



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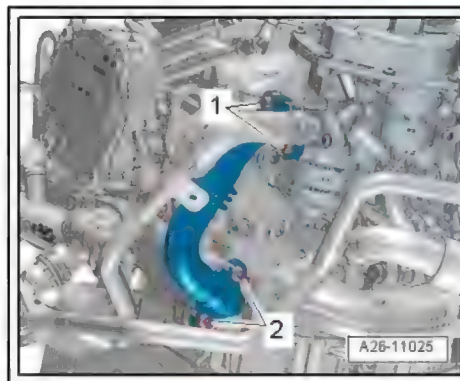


- Remove bolts -2- and detach exhaust gas recirculation pipe.



Note

Disregard -item 1-.



- Unplug electrical connector -3-.
- Remove bolt -1- and nut -2- and push rear coolant pipe clear to one side.



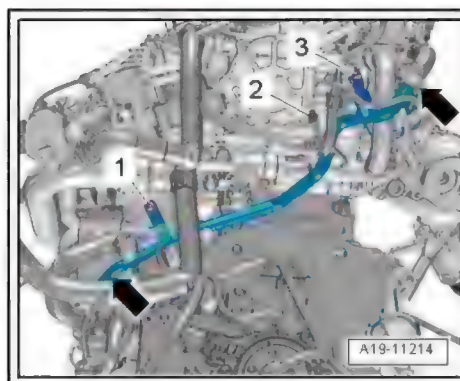
Note

Disregard -arrows-.

- Remove particulate filter forwards.

Installing

Installation is carried out in reverse order; note the following:



Note

Renew gaskets and nuts.

- Secure coolant pipe (rear) ⇒ [page 185](#) .
- Install exhaust gas recirculation pipe ⇒ [page 290](#) .
- Install oil pressure switch - F1- ⇒ [page 146](#) .
- Install turbocharger ⇒ [page 203](#) .
- Install exhaust gas recirculation cooler ⇒ [page 291](#) .
- Align the exhaust system so it is free of stress ⇒ [page 279](#) .
- After renewing particulate filter, perform Adaption in Guided Functions ⇒ Vehicle diagnostic tester.

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencers", page 273](#)
- ◆ ⇒ ["3.1 Exploded view - exhaust gas temperature control", page 284](#)

2.2 Removing and installing pressure differential sender - G505-



Note

The pressure differential sender - G505- detects the amount of deposits in the particulate filter.

Special tools and workshop equipment required



◆ Vehicle diagnostic tester

Removing

- Remove engine cover panel ➔ [page 41](#) .
- Unplug electrical connector -3-.
- Unscrew bolt -2- and detach pressure differential sender - G505- .
- Before disconnecting, spray the hoses for the pressure differential sender - G505- with suitable release agent.
- Carefully disconnect the hoses from their connections (take care to keep the hoses straight: the connections on pressure sensor can break off easily).

Installing

Installation is carried out in reverse order; note the following:



Note

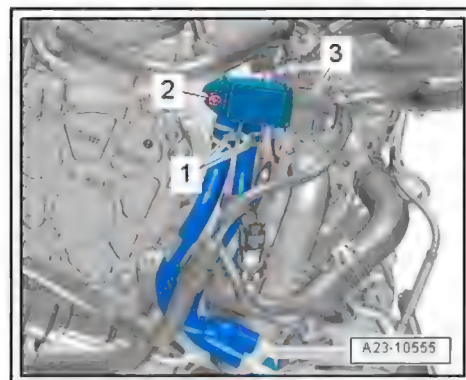
- ◆ *Before installing, blow out pressure pipes from pressure differential sender - G505- to particulate filter towards particulate filter with compressed air (pipes can become obstructed or may ice up due to condensation).*
- ◆ *Make sure that hoses are securely fitted and that there are no leaks.*
- ◆ *If pressure pipes were loosened on particulate filter, tighten pressure pipe connections ➔ [page 266](#) .*
- “Adaption” must be performed after renewing pressure differential sender ➔ Vehicle diagnostic tester.

After renewing pressure differential sender - G505- and/or particulate filter, adaption must be performed in order to reset learnt values. The adaption procedure is described in the Guided Fault Finding or Guided Functions.

Use ➔ Vehicle diagnostic tester.

Tightening torques

- ◆ ➔ [“8.1 Exploded view - Lambda probe”, page 266](#)



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3 Exhaust gas temperature control

⇒ "3.1 Exploded view - exhaust gas temperature control",
page 284

⇒ "3.2 Removing and installing exhaust gas temperature sender",
page 285

3.1 Exploded view - exhaust gas temperature control

1 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing
⇒ [page 285](#)
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm

2 - Turbocharger

3 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing
⇒ [page 266](#)

4 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing
⇒ [page 286](#)
- ☐ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ☐ 60 Nm

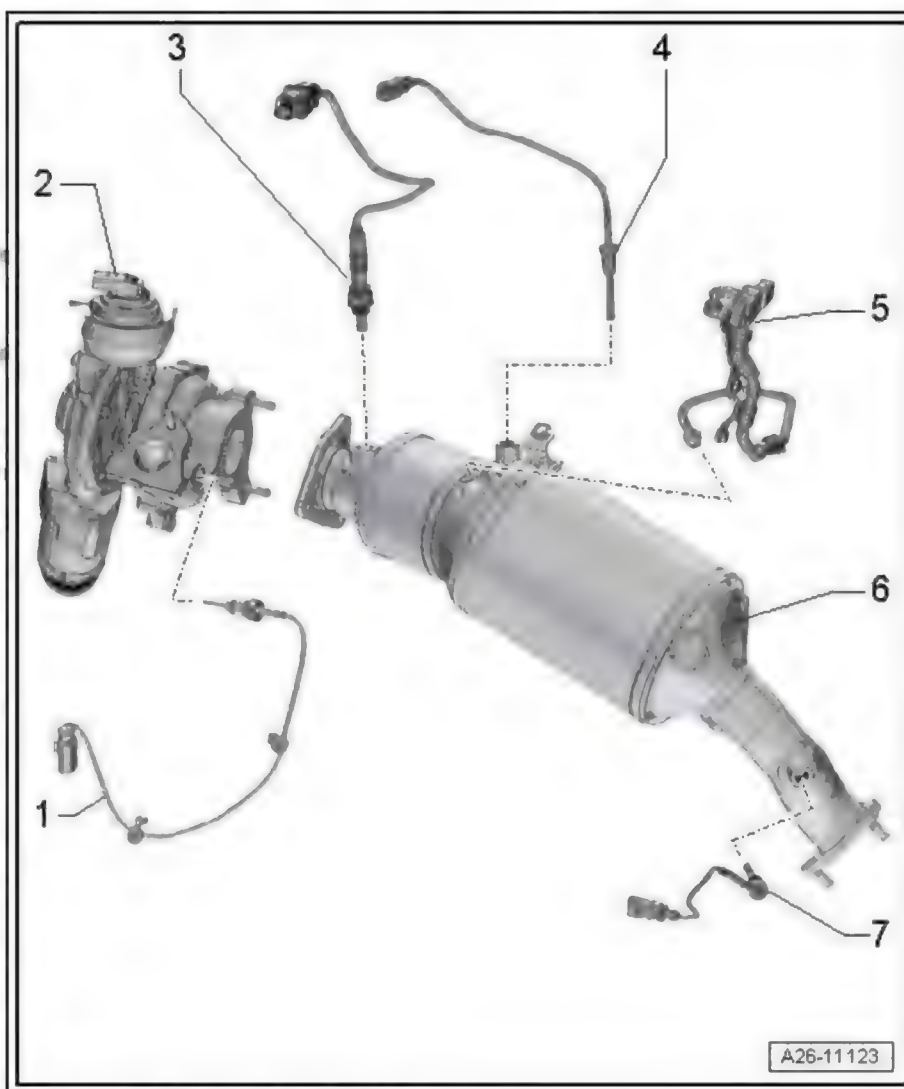
5 - Pressure differential sender - G505-

- ☐ Removing and installing
⇒ [page 282](#)
- ☐ Pressure pipes to particulate filter: 45 Nm
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

6 - Particulate filter

7 - Exhaust gas temperature sender 4 - G648-

- ☐ Removing and installing ⇒ [page 288](#)
- ☐ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ☐ 60 Nm





3.2 Removing and installing exhaust gas temperature sender

⇒ "3.2.1 Removing and installing exhaust gas temperature sender 1 G235", page 285

⇒ "3.2.2 Removing and installing exhaust gas temperature sender 3 G495", page 286

⇒ "3.2.3 Removing and installing exhaust gas temperature sender 4 G648", page 288

3.2.1 Removing and installing exhaust gas temperature sender 1 - G235-

Special tools and workshop equipment required

◆ Tool set - T10395 A-



Removing



Note

Fit all cable ties in the original positions when installing.



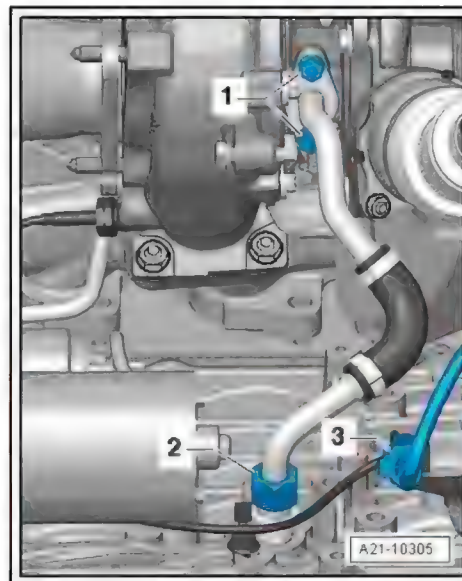
WARNING

When working on all parts of the exhaust system:

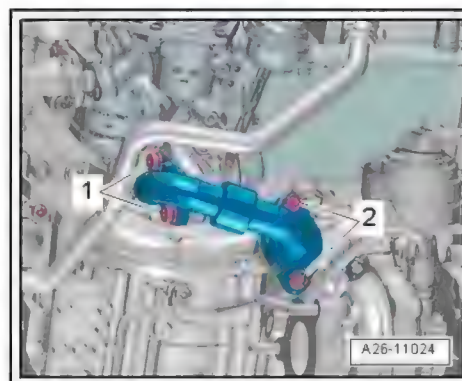
- ◆ *Observe safety precautions when working on the exhaust system*
⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

- Remove air cleaner housing ⇒ [page 227](#) .
- Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

- Unplug electrical connector -3- for exhaust gas temperature sender 1 - G235- and unclip at bottom.
- Remove Lambda probe - G39- ➔ [page 266](#) .



- Remove bolts -1, 2- and detach exhaust gas recirculation pipe.



- Unscrew exhaust gas temperature sender 1 - G235- -item 1- using a tool from tool set - T10395 A- and unclip electrical wire -arrow-.

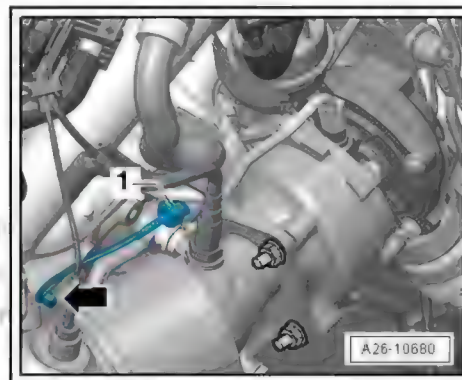
Installing

Installation is carried out in reverse order; note the following:

- Install Lambda probe - G39- ➔ [page 266](#) .
- Install air cleaner housing ➔ [page 227](#) .
- Electrical connections and routing ➔ Current flow diagrams, Electrical fault finding and Fitting locations.

Tightening torques

- ◆ ➔ ["3.1 Exploded view - exhaust gas temperature control", page 284](#)
- ◆ ➔ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation



3.2.2 Removing and installing exhaust gas temperature sender 3 - G495-

Special tools and workshop equipment required



◆ Tool set - T10395 A-



Removing



Note

Fit all cable ties in the original positions when installing.



WARNING

When working on all parts of the exhaust system:

- ◆ *Observe safety precautions when working on the exhaust system*
⇒ "2.6 Safety precautions when working on the exhaust system", page 4 .

- Remove engine cover panel ⇒ [page 41](#) .
- Detach electrical connector -3- from bracket.
- Unplug electrical connector -4- and move clear.
- Unscrew exhaust gas temperature sender 3 - G495- -item 2- using a tool from tool set - T10395 A- .



Note

Disregard -item 1-.

Installing

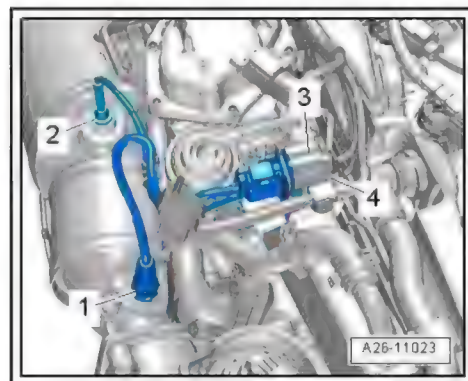
Installation is carried out in reverse order; note the following:



Caution

Risk of malfunctions caused by improperly secured exhaust gas temperature senders.

- ◆ *The threads of the exhaust gas temperature senders - G495- and -G648- are coated. It is important that you do NOT grease them additionally with high-temperature paste and that you tighten them to the specified torque.*



Tightening torques

- ◆ ⇒ ["3.1 Exploded view - exhaust gas temperature control", page 284](#)

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3.2.3 Removing and installing exhaust gas temperature sender 4 - G648-

Special tools and workshop equipment required

- ♦ Tool set - T10395 A-



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Removing

- Remove front exhaust pipe ➔ [page 275](#) .

Vehicles with manual gearbox:

- Unclip electrical connector -C- from bracket -B- and unplug.



Note

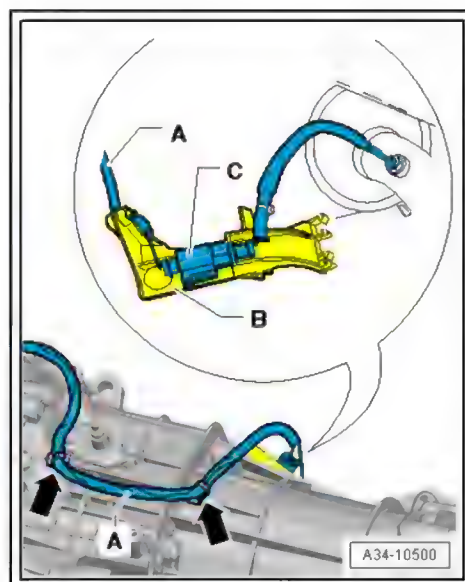
Disregard -item A- and -arrows-.



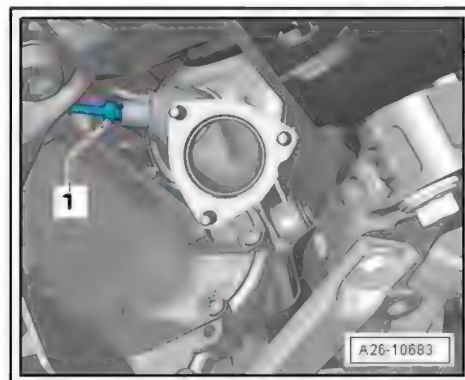
WARNING

When working on all parts of the exhaust system:

- ♦ Observe safety precautions when working on the exhaust system
➔ ["2.6 Safety precautions when working on the exhaust system", page 4](#) .



- Unscrew exhaust gas temperature sender 4 - G648- -item 1- using a tool from tool set - T10395 A- .



Vehicles with multitronic gearbox:

- Unclip electrical connector -2- from bracket and unplug.
- Unscrew exhaust gas temperature sender 4 - G648- -item 1- using a tool from tool set - T10395 A-

Installing

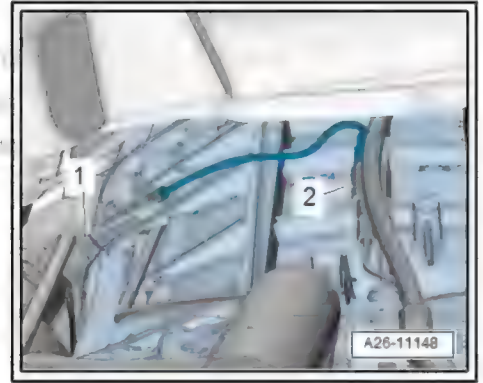
Installation is carried out in reverse order; note the following:



Caution

Risk of malfunctions caused by improperly secured exhaust gas temperature senders.

- ◆ *The threads of the exhaust gas temperature senders - G495- and -G648- are coated. It is important that you do NOT coat them additionally with high-temperature paste and that you tighten them to the specified torque.*



- Install front exhaust pipe ⇒ [page 275](#) .

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - silencers", page 273](#)
- ◆ ⇒ ["3.1 Exploded view - exhaust gas temperature control", page 284](#)

4 Exhaust gas recirculation

⇒ "4.1 Exploded view - exhaust gas recirculation system",
page 290

⇒ "4.2 Removing and installing exhaust gas recirculation cooler",
page 291

⇒ "4.3 Checking exhaust gas recirculation cooler change-over",
page 293

⇒ "4.4 Cleaning exhaust gas recirculation system", page 294

4.1 Exploded view - exhaust gas recirculation system

1 - Gasket

☐ Renew

2 - Bolt

☐ 9 Nm

3 - Exhaust gas recirculation
pipe

4 - Bolt

☐ 9 Nm

5 - Gasket

☐ Renew

6 - Bolt

☐ 9 Nm

7 - Coolant hose

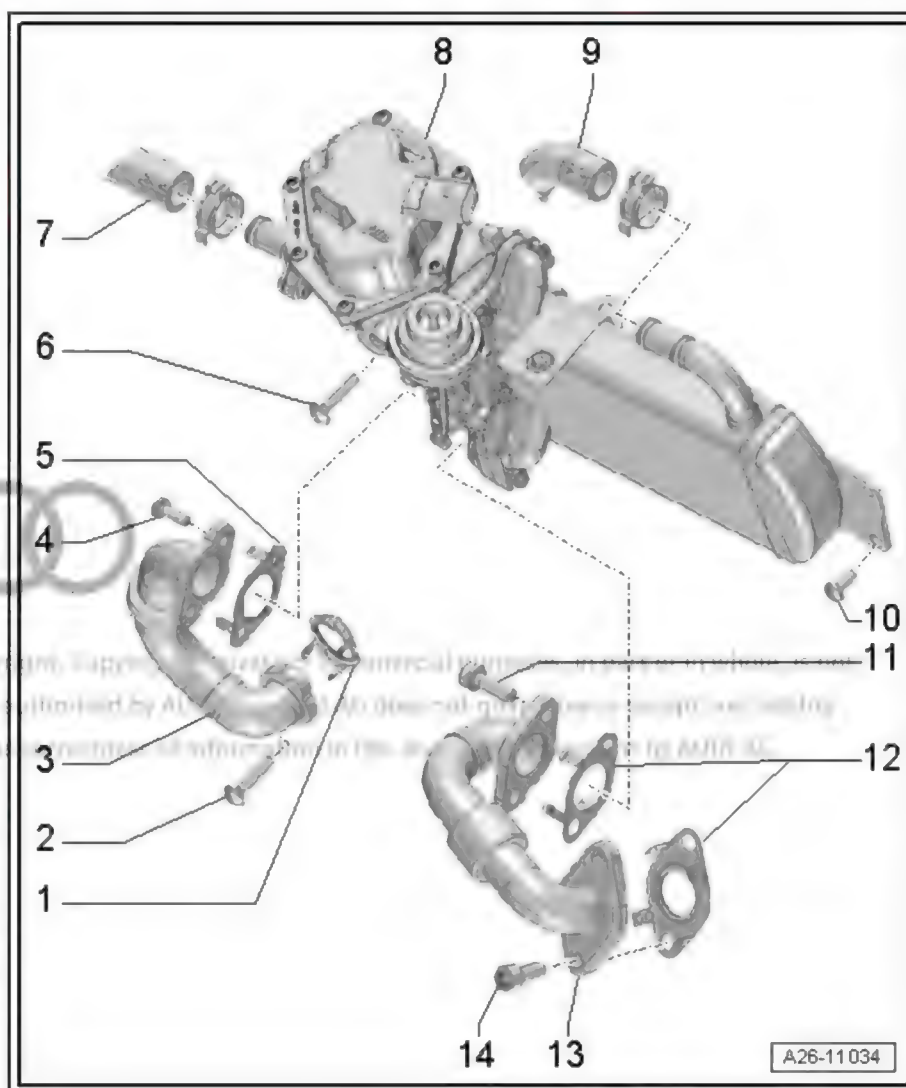
8 - Exhaust gas recirculation
cooler

☐ With integrated exhaust
gas recirculation control
motor - V338- with ex-
haust gas recirculation
potentiometer - G212-

☐ Checking change-over
function ⇒ [page 293](#)

☐ Removing and installing
⇒ [page 291](#)

☐ After renewing exhaust
gas recirculation control
motor - V338- , learnt
values must be re-adap-
ted; see [Guided Func-
tions](#) of ⇒ Vehicle di-
agnostic tester, [01 -
Adaption elec. ad-
juster with checkback](#)



9 - Coolant hose

10 - Bolt

☐ 9 Nm

11 - Bolt

☐ 23 Nm

12 - Gaskets

☐ Renew



13 - Exhaust gas recirculation pipe

14 - Bolt

- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ➔ Electronic parts catalogue
- ☐ 23 Nm

4.2 Removing and installing exhaust gas recirculation cooler

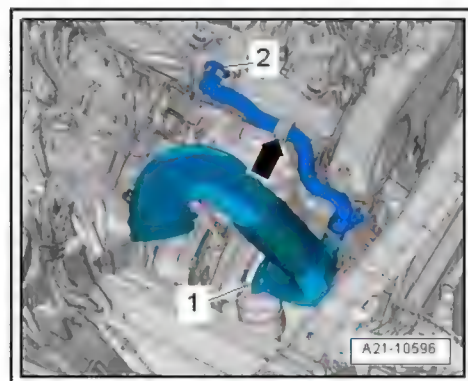
Special tools and workshop equipment required

- ◆ Hose clip pliers - VAS 6362-



Removing

- Drain coolant ➔ [page 162](#) .
- Remove engine cover panel ➔ [page 41](#) .
- Remove air cleaner housing ➔ [page 227](#) .
- Press release tabs, disconnect crankcase breather hose -2- and move hose clear -arrow-.
- Loosen hose clip -1- and remove air hose.



- Remove bolt and nut -arrows-.
- Release hose clip -3- and detach coolant hose.

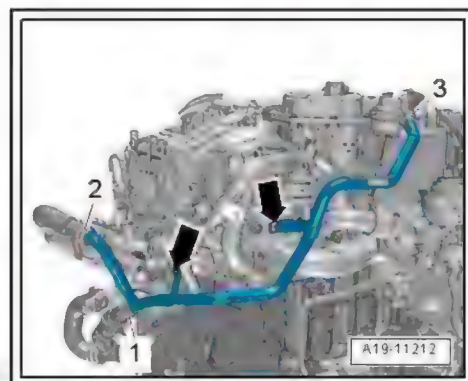


Note

Disregard items -1 and 2-.



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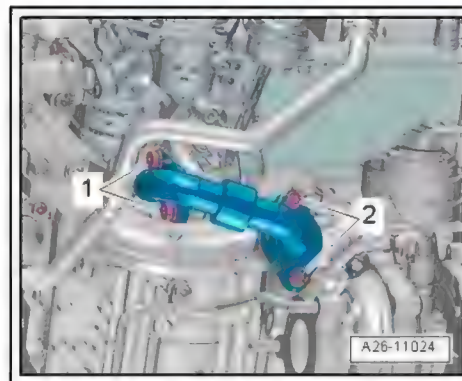


- Remove bolts -2- for exhaust gas recirculation pipe.



Note

Disregard -item 1-.

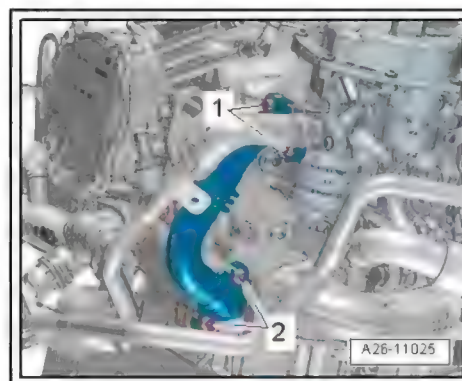


- Remove bolts -1- for exhaust gas recirculation pipe.



Note

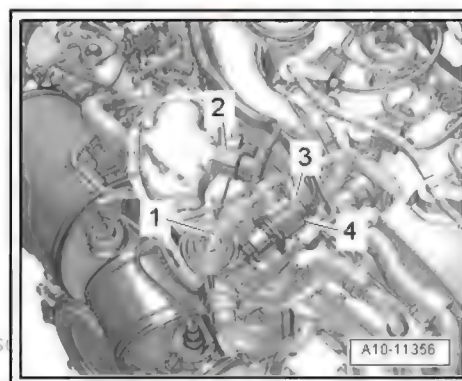
Disregard -item 2-.



- Unplug electrical connectors -2, 3, 4- and move electrical wiring clear.
- Detach vacuum hose -1- and move clear.



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- Move fuel hoses clear at exhaust gas recirculation cooler.
- Release hose clip -2- and detach coolant hose.
- Remove bolts -1, 3- and detach exhaust gas recirculation cooler.

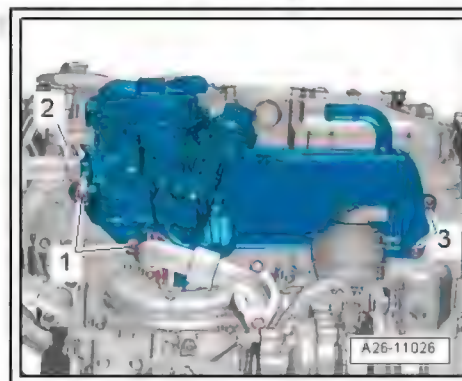
Installing

Installation is carried out in reverse order; note the following:



Note

- ◆ Renew gaskets and O-ring.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .





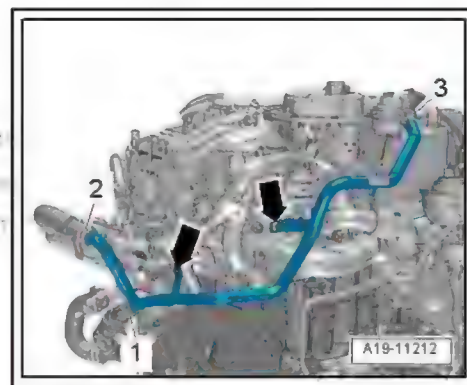
- Attach coolant hose and secure with hose clip -3-.
- Tighten bolt and nut -arrows- to secure coolant pipe.
- Install air cleaner housing ➔ [page 227](#) .



Note

Do not reuse coolant.

- Fill up with coolant ➔ [page 164](#) .
- After renewing exhaust gas recirculation control motor - V338- , learnt values must be re-adapted; see Guided Functions of ➔ Vehicle diagnostic tester, 01 - Adaption elec. adjuster with checkback.



Tightening torques

- ◆ ➔ ["4.1 Exploded view - exhaust gas recirculation system", page 290](#)
- ◆ ➔ ["3.1 Exploded view - coolant pipes", page 179](#)
- ◆ ➔ ["2.2 Exploded view - hose connections for charge air system", page 209](#)

4.3 Checking exhaust gas recirculation cooler change-over

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-

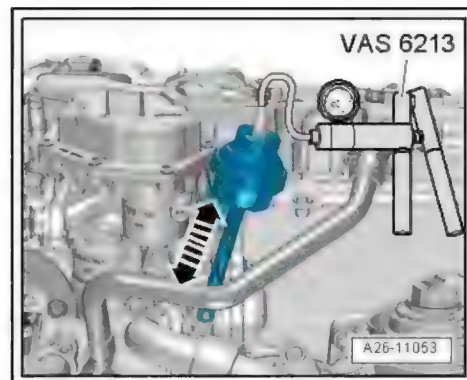


Procedure

- Remove engine cover panel ➔ [page 41](#) .
- Disconnect vacuum hose from vacuum unit and connect hand vacuum pump - VAS 6213- in its place.
- Operate hand vacuum pump to produce a vacuum.
- The linkage of the exhaust gas recirculation cooler change-over should move -arrows-.

If the linkage does not move or only moves jerkily:

- ◆ The vacuum unit is defective.
- ◆ The change-over flap for exhaust gas recirculation is sticking.





4.4 Cleaning exhaust gas recirculation system



Note

- ◆ The cleaning process is only worthwhile for exhaust gas recirculation coolers from part number 03L 131 512 DT onwards.
- ◆ Check the part number before starting work.

Explanation:

Certain extreme driving modes (e.g. short distances) may result in varnish formation/carbon deposits inside the exhaust gas recirculation cooler. In this case, the exhaust emissions warning lamp in the instrument cluster lights up and the following code appears in the event memory:

- ◆ P401 EGR system throughput too low

In these cases, these carbon deposits can be removed by carrying out the rinsing/cleaning procedure described below.

Special tools and workshop equipment required

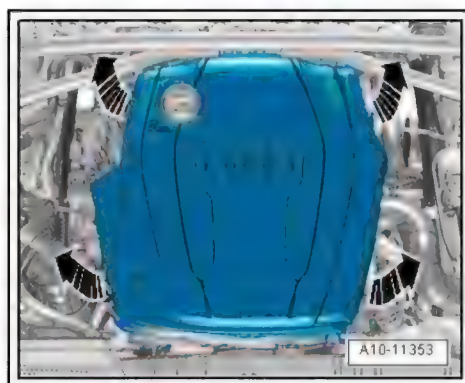
- ◆ Cooler rinsing system for exhaust gas recirculation - VAS 542 007-



- ◆ Adapter - VAS 542 007/4-1-
- ◆ Ultrasonic cleaning unit - VAS 6418-

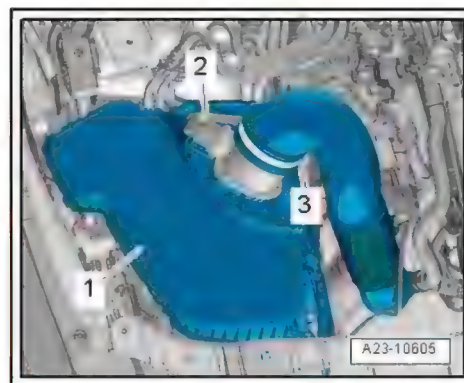
Starting cleaning procedure for exhaust gas recirculation system

- Remove engine cover panel -arrows-.

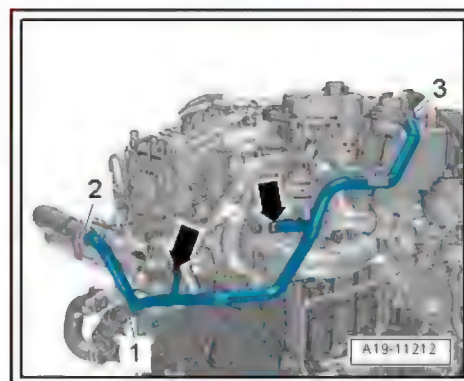




- Remove air cleaner housing and air hose
⇒ ["3.2 Removing and installing air cleaner housing", page 227](#) .



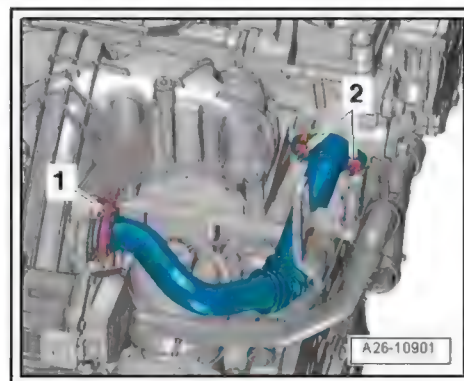
- Remove bolt and nut -arrows- from coolant pipe.



- Remove bolts -1 and 2- for connecting pipe for exhaust gas recirculation. It will be necessary to press coolant pipe slightly to side in order to access rear bolt.
- Screw adapter - VAS 542 007/4-1- onto connection of exhaust gas recirculation cooler using original bolts from connecting pipe and hand-tighten. Ensure that seal on adapter is not pinched.

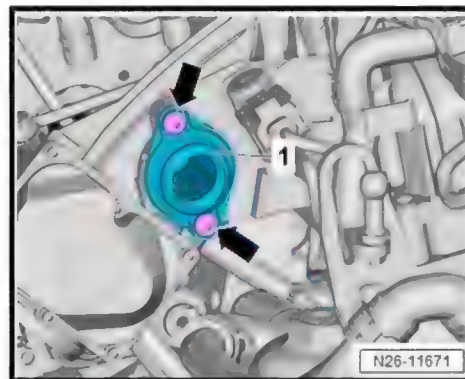


- Remove bolts -2-, open clamp -1- for connecting pipe for exhaust gas recirculation and detach connecting pipe.
- Screw adapter - VAS 542 007/4-1- onto connection on cylinder head using original bolts from connecting pipe and hand-tighten. Ensure that seal on adapter is not pinched.



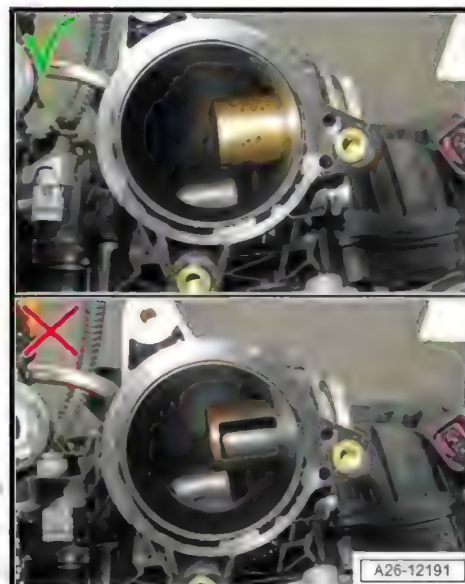
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- Remove bolts -arrows- and pull pipe connection -1- out of intake manifold.



Note

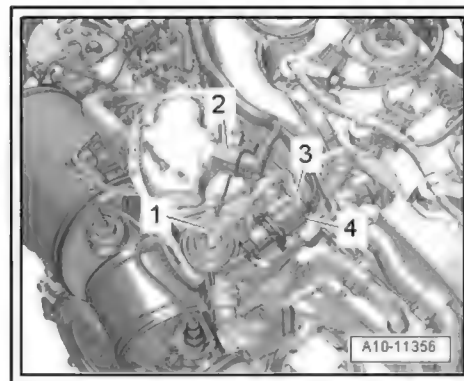
- Check whether the opening of the pipe connection faces towards the cylinder head; if not, the pipe connection must be installed rotated through 180°.
- If necessary, use a suitable file to create a new recess in addition to the existing recess in the support plate of the pipe connection.
- The pipe connection that has been modified in this way can then be installed rotated through 180° after it has been cleaned.
- When installing the pipe connection, make sure that the opening faces towards the cylinder head.





- Release and unplug electrical connector -2- from exhaust gas recirculation valve - N18- .
- Plug electrical connector of valve actuator - VAS 542007/6- into exhaust gas recirculation valve - N18- .

Cleaning connecting pipes and pipe connection for exhaust gas recirculation:



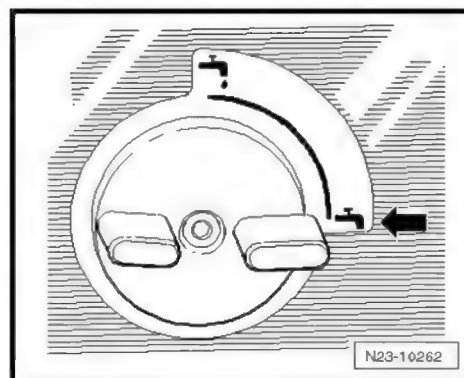
- Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).



Note

The ultrasonic bath can be heated up more quickly by using hot tap water.

- Fill ultrasonic cleaning unit - VAS 6418- with 1800 ml of hot (approx. 60 °C) tap water and 200 ml of cleaning fluid -D 600 200 A2- .
- Put connecting pipes and pipe connection for exhaust gas recirculation in. If necessary, change the position of the connecting pipes in the bath occasionally.





- Switch on cleaning unit by pressing **on/off** button -C-.
- Turn rotary temperature control -B- until LED for heating temperature is at 60 °C.
- Set rotary control for operating time -A- to 10 -arrow-.
- Press **▶** -D- button to start unit running.



Note

After a temperature of 60 °C has been reached, the cleaning process must last for at least 10 minutes.

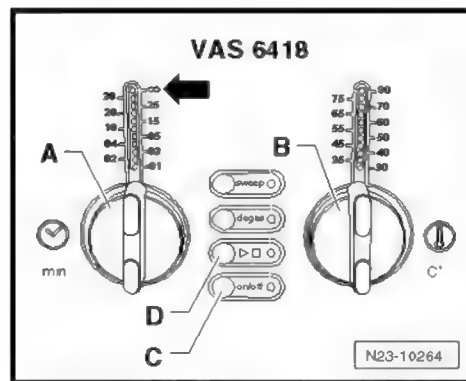
- After cleaning successfully, rinse connecting pipes and pipe connection for exhaust gas recirculation with clean water and blow out with compressed air.

On vehicle (continued):

- Connect intake hose - VAS 542007/2-2- of cleaning unit to adapter on exhaust gas recirculation cooler.
- Connect return hose - VAS 542007/2-3- of cleaning unit to adapter on cylinder head.
- Connect battery charger to battery.
- Connect battery clamps of valve actuator - VAS 542007/6- to battery.
- Connect battery clamps of pump - VAS 542007/3- to battery.

Preparing cooler rinsing system for exhaust gas recirculation - VAS 542 007- :

- Fill canister - VAS 542007/1- with 9 litres of warm (approx. 40 ° C) tap water.
- Pour 1 litre of cleaning solution - D 600 200 A2- into canister.

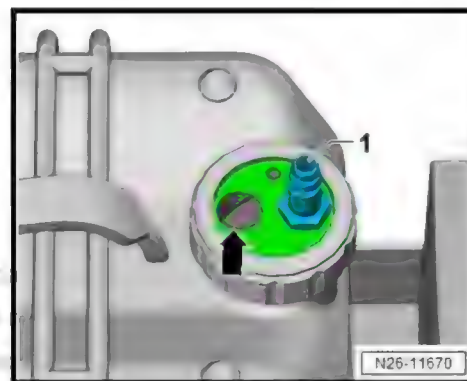


- Connect suction hose - VAS 542007/2-1- of pump to connection -1- on canister lid.
- Insert open end of return hose - VAS 542007/2-3- into opening -arrow- on canister lid to approx half height of canister.
- Plug electrical connector of valve actuator - VAS 542007/6- into exhaust gas recirculation valve - N18- .
- Switch on valve actuator - VAS 542007/6- to open exhaust gas recirculation valve.



Note

- ◆ Ensure that the bleeder screw tap on the intake hose - VAS 542007/2-2- is closed.
- ◆ If the pressure (approx. 1.6 bar) provided by the pump - VAS 542007/3- is not sufficient to activate the exhaust gas recirculation valve via the valve actuator - VAS 542007/6- , the pump will switch itself off after a short period.
- ◆ In this case, the exhaust gas recirculation valve has a mechanical fault or is not supplied with current. The exhaust gas recirculation cooler must be renewed.
- ◆ Before disconnecting the intake hose - VAS 542007/2-2- , the pressure must be released by carefully opening the bleeder screw tap and escaping cleaning solution must be caught.



Operate pump - VAS 542007/3- as follows:

Pump - VAS 542007/3-	Time	Action
Switch on	25 minutes	Cleaning
Switch off	10 minutes	Cleaning solution taking effect
Switch on	25 minutes	Cleaning
Switch off	---	End of cleaning procedure

- Disconnect intake hose - VAS 542007/2-1- from canister and leave pump switched on until no more cleaning solution is extracted (empty the system).
- Pull return hose - VAS 542007/2-3- out of canister (cleaning solution may come out).
- Empty canister (observe country-specific requirements for disposal).
- Fill canister with 10 litres of warm (approx. 40 °C – 50 °C) tap water.

- Connect intake hose - VAS 542007/2-1- of pump to connection -1- on canister lid.
- Insert open end of return hose - VAS 542 007/2-3- into a suitable container (minimum capacity of 12 litres) and fix in position.
- Switch on pump - VAS 542007/3- and leave it on until the contents of the canister have fully flowed through the exhaust gas recirculation system.
- Detach intake hose - VAS 542007/2-2- from adapter on exhaust gas recirculation cooler.
- Connect compressed air adapter - VAS 542007/5- to adapter on exhaust gas recirculation cooler.
- Insert open end of return hose - VAS 542 007/2-3- into opening -arrow- on canister lid to approx half height of canister.
- Intake hose - VAS 542 007/2-1- of pump must be connected to connection -1- on canister lid.
- Connect compressed air line to compressed air adapter - VAS 542007/5- and blow all remaining water out of exhaust gas recirculation system (minimum 2 minutes).

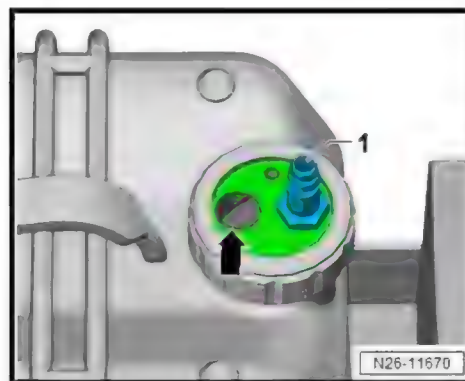


Caution

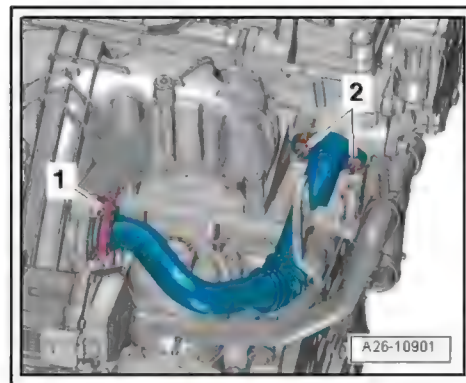
All water must be removed from the exhaust gas recirculation system. Otherwise the engine could be damaged.

- Release and unplug compressed air adapter - VAS 542007/5-.
- Remove adapter - VAS 542 007/4-1- from exhaust gas recirculation cooler.
- Install exhaust gas recirculation pipe with new gaskets.
- Unplug connector for valve actuator - VAS 542007/6- on exhaust gas recirculation valve - N18- and plug in original connector.
- Remove adapter - VAS 542 007/4-1- from cylinder head.

- Position pipe connection -1- with new gasket on cylinder head with opening facing intake manifold.
- Screw in bolts -arrows- and tighten to 9 Nm.



- Install connecting pipe for exhaust gas recirculation with new gasket and clamp.
- Install engine cover panel.
- After cleaning, the effectiveness of the cleaning process must be checked with ⇒ Vehicle diagnostic tester.
- Connect ⇒ Vehicle diagnostic tester.
- Interrogate event memory and erase entries if necessary.
- Select **Diagnosis** mode and then **Start diagnosis**.
- Choose **Select own test** tab and select following options one after the other:
 - ◆ **Drive train**
 - ◆ **Select engine code and engine**
 - ◆ **01 - Self-diagnosis compatible systems**
 - ◆ **01 - Engine electronics**
 - ◆ **01 - Engine electronics, functions**
 - ◆ **01 - Check exhaust gas recirculation valve 1 -GX5 after cleaning according to the repair manual**
- Perform road test.



Tightening torques:

- ◆ ⇒ **"4.1 Exploded view - exhaust gas recirculation system", page 290**



5 Exhaust manifold

⇒ "5.1 Exploded view - exhaust manifold", page 302

⇒ "5.2 Removing and installing exhaust manifold", page 303

5.1 Exploded view - exhaust manifold

1 - Gasket

- ☐ Renew

2 - Exhaust manifold

- ☐ Removing and installing
⇒ [page 303](#)

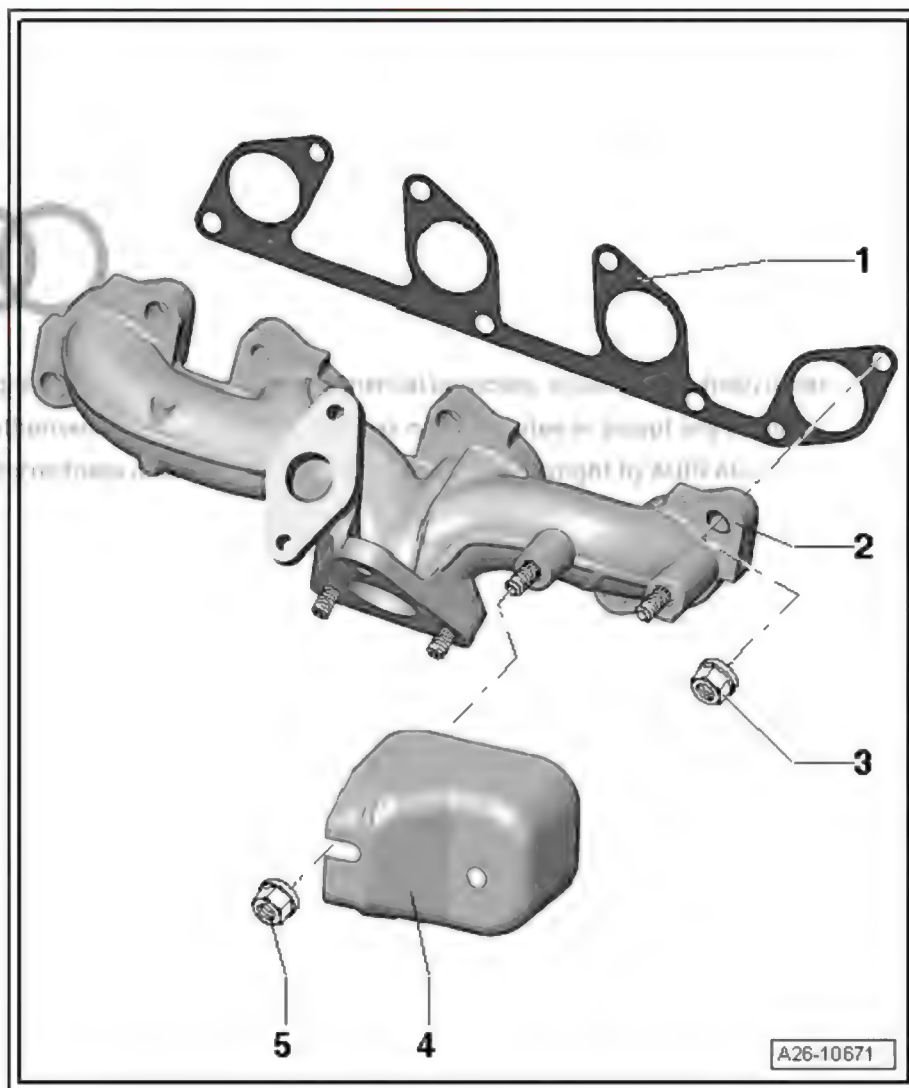
3 - Nut

- ☐ 25 Nm
- ☐ Renew
- ☐ Lubricate exhaust manifold studs with high-temperature paste
- ☐ If studs are renewed, too, tighten them to 15 Nm

4 - Heat shield

5 - Nut

- ☐ 25 Nm



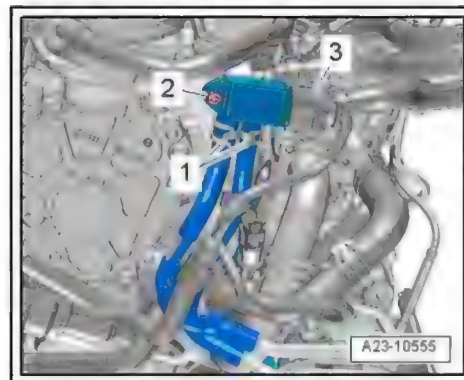
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5.2 Removing and installing exhaust manifold

Removing

- Remove turbocharger ⇒ [page 203](#) .
- Unplug electrical connector -3- for pressure differential sender - G505- .
- Remove bolt -2- and move hoses -1- clear at bracket.
- Move pressure differential sender - G505- to rear.

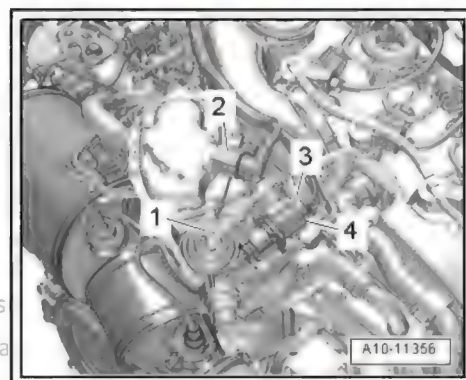


- Detach electrical connectors from bracket and unplug.
- 3 - For Lambda probe - G39-
- 4 - For exhaust gas temperature sender 3 - G495-
- Move particulate filter to rear.



Note

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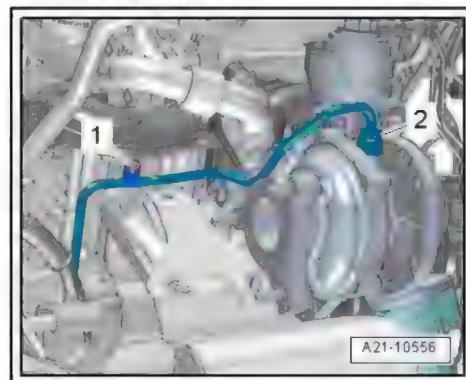


- Remove bolt -1- at retaining clamp for oil supply line.

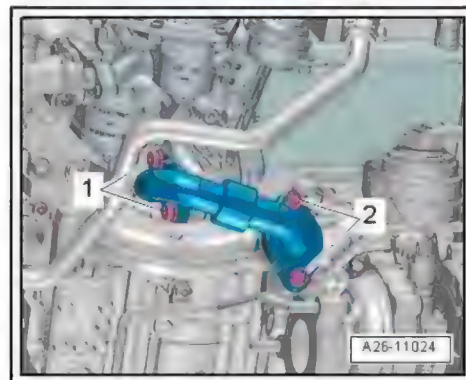


Note

Disregard -item 2-.

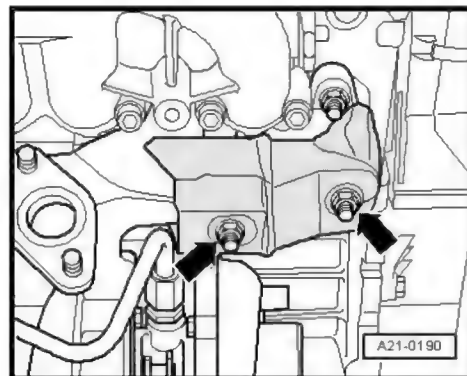


- Remove bolts -1, 2- and detach exhaust gas recirculation pipe.





- Remove nuts -arrows- and detach heat shield.



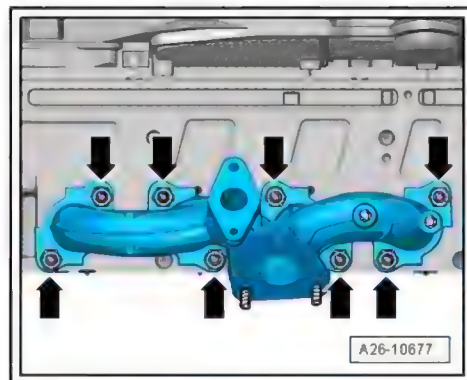
- Remove nuts -arrows-.



Caution

Risk of damage to oil supply line.

- ◆ *Do not attempt to bend oil supply line to a different shape.*



- Detach exhaust manifold.

Installing

Installation is carried out in reverse order; note the following:



Note

Renew gaskets and nuts.

- Install pressure differential sender - G505- ➔ [page 282](#) .
- Install turbocharger ➔ [page 203](#) .
- Electrical connections and routing ➔ Current flow diagrams, Electrical fault finding and Fitting locations.

Tightening torques

- ◆ ➔ [“5.1 Exploded view - exhaust manifold”, page 302](#)
- ◆ ➔ [“4.1 Exploded view - exhaust gas recirculation system”, page 290](#)



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28 – Glow plug system

1 Glow plug system

⇒ "1.1 Exploded view - glow plug system", page 305

⇒ "1.2 Removing and installing glow plug", page 305

⇒ "1.3 Removing and installing Hall sender G40 ", page 307

⇒ "1.4 Removing and installing engine speed sender G28 ", page 308

1.1 Exploded view - glow plug system

1 - Hall sender - G40-

- ☐ Removing and installing
⇒ [page 307](#)

2 - Bolt

- ☐ 10 Nm

3 - Glow plug

- ☐ Glow plug 1 - Q10- ,
glow plug 2 - Q11- , glow
plug 3 - Q12- , glow
plug 4 - Q13-

- ☐ Removing and installing
⇒ [page 305](#)

- ☐ 17 Nm

4 - Electrical connector

- ☐ For glow plug

5 - Bolt

- ☐ 4.5 Nm

6 - Engine speed sender - G28-

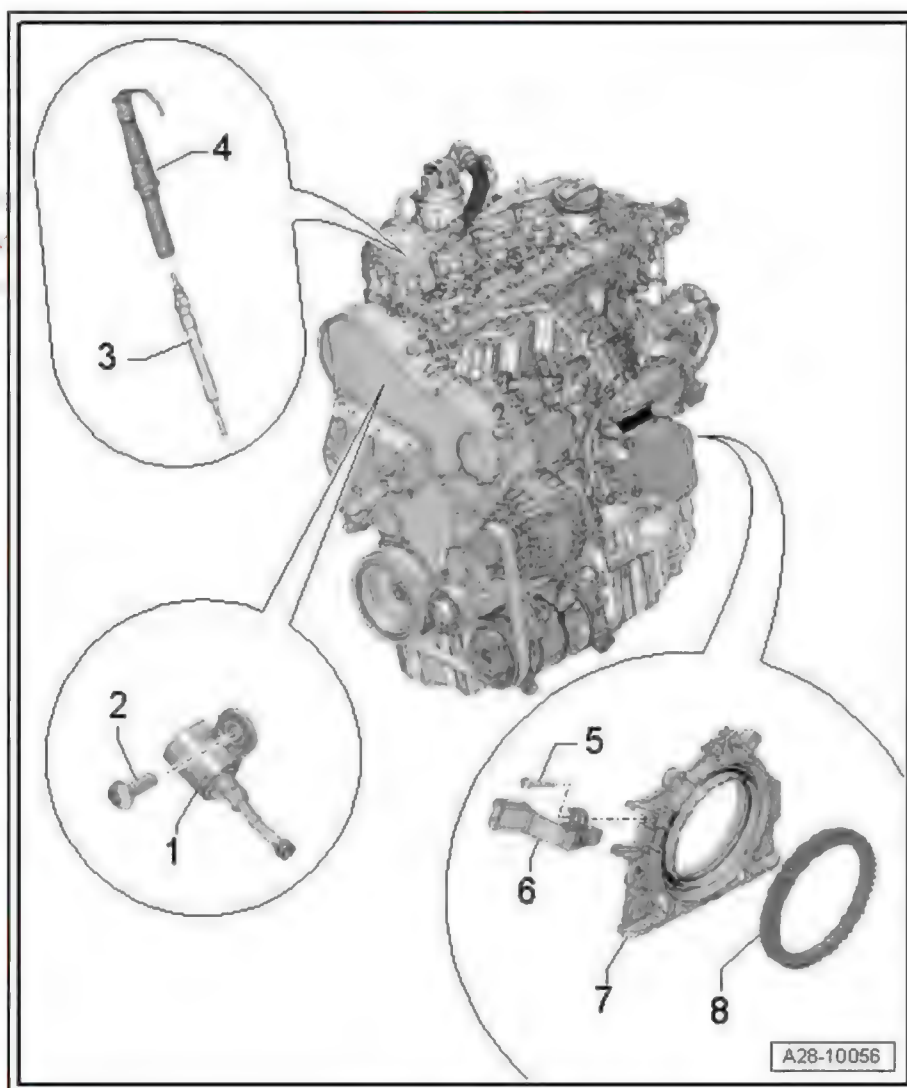
- ☐ Removing and installing
⇒ [page 308](#)

7 - Sealing flange (gearbox end)

- ☐ With oil seal
- ☐ Renewing ⇒ [page 57](#)

8 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing
⇒ "2.3 Removing and installing sealing flange (gearbox end)",
[page 57](#)



1.2 Removing and installing glow plug

Special tools and workshop equipment required



- ◆ Articulated wrench, 10 mm - 3220-



- ◆ Pliers - 3314-



Removing

- Switch off ignition.
- Remove engine cover panel ⇒ [page 41](#) .
- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.



Note

- ◆ *Cleaning procedure:*
- ◆ *Use a vacuum cleaner to remove coarse dirt.*
- ◆ *Spray brake cleaner or suitable cleaning agent into glow plug openings, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug openings using a cloth moistened with oil.*
- Release retaining clips at wiring harness and detach electrical connectors from glow plugs.

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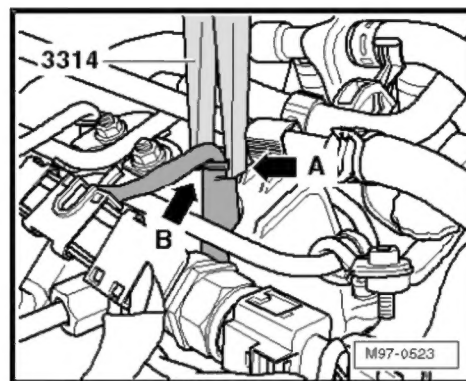


- Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- and pull glow plug connectors off glow plugs.



Caution

Make sure that no wire connection is damaged when unplugging the glow plug connectors; otherwise the entire wiring harness must be renewed. When unplugging the glow plug connectors, do not compress the pliers - 3314- with too much force so that the support sleeve is not damaged.



- To slacken the glow plugs use special tool U/J extension and socket, 10 mm - 3220-

Installing

Installation is carried out in reverse order; note the following:

- Fit glow plug connectors -1- back onto glow plugs -arrow-.

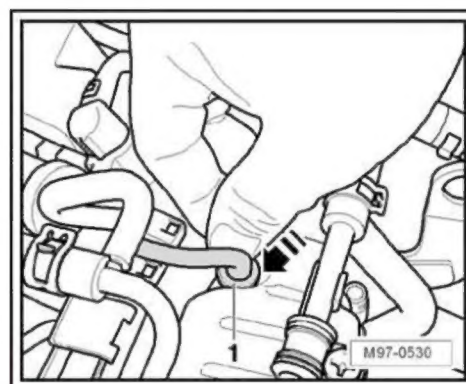


Note

Check that glow plug connectors are securely seated.

Tightening torques

- ♦ ⇒ ["1.1 Exploded view - glow plug system", page 305](#)



1.3 Removing and installing Hall sender - G40-

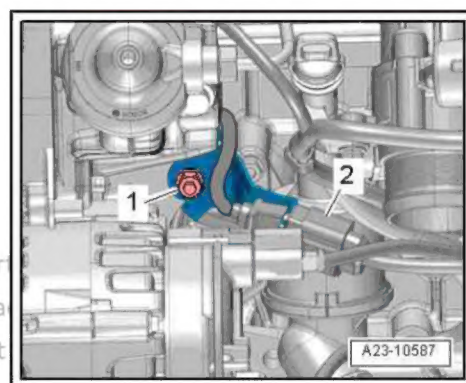
Removing

- Detach toothed belt from idler roller and high-pressure pump
⇒ [page 83](#) .
- Detach electrical connector -2- from bracket and unplug.



Note

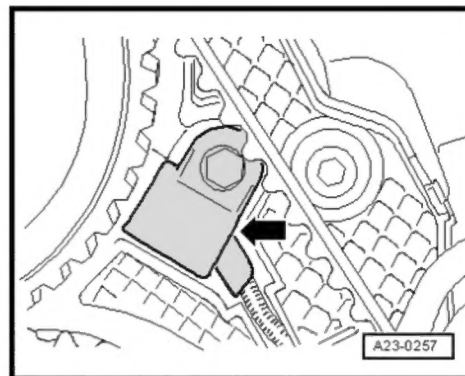
Disregard -item 1-.



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- Unbolt Hall sender - G40- -arrow-.



- Using a screwdriver, remove projections and take out cover for repair opening -arrows-.
- Take Hall sender - G40- off cylinder head and guide its connector through repair opening in toothed belt cover.

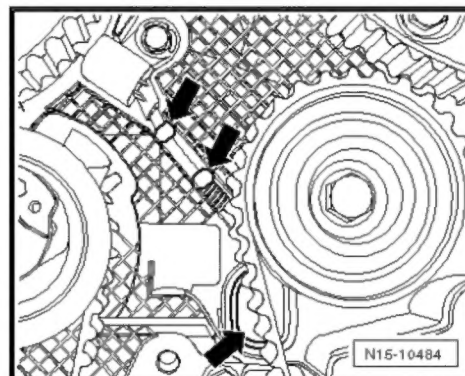
Installing

Installation is carried out in reverse order; note the following:

- Seal repair opening in toothed belt cover with rubber plug; for rubber plug refer to ⇒ Electronic parts catalogue .
- Fit toothed belt and adjust valve timing ⇒ [page 87](#) .

Tightening torques

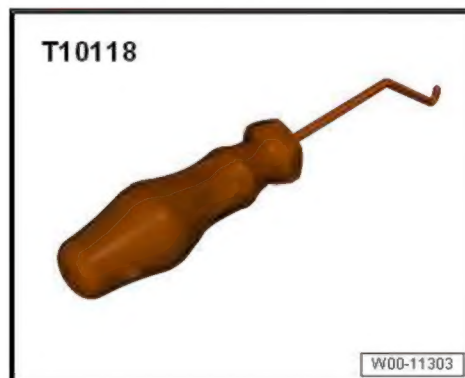
- ♦ ⇒ ["1.1 Exploded view - glow plug system", page 305](#)



1.4 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

- ♦ Assembly tool - T10118-



Removing

- Remove pump for exhaust gas recirculation cooler - V400- ⇒ [page 170](#) .
- Unplug electrical connector -1- at engine speed sender - G28- using assembly tool - T10118- .



- Move wiring clear.



Note

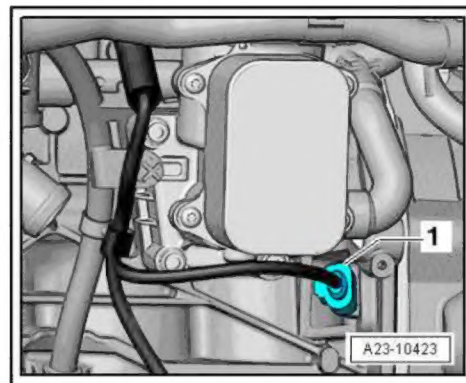
- ◆ *To release electrical connector without assembly tool - T10118- , use a screwdriver.*
 - ◆ *Press in connector on engine speed sender.*
 - ◆ *At the same time, lift release tab with a thin wire hook.*
- Remove bolt from engine speed sender - G28- .

Installing

Installation is carried out in reverse sequence.

Tightening torques

- ◆ ⇒ ["1.1 Exploded view - glow plug system", page 305](#)
- ◆ ⇒ ["2.2 Exploded view - electric coolant pump", page 170](#)



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